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Forthcoming Events.

MAY 22.

Diesel Engine Users' Association:—Ordinary meeting in London. "Pyrometry of Exhaust Temperatures of Internal Combustion Engines." Paper by Chas. E. Foster, F.Inst.P.

Institution of Mechanical Engineers:—Extra general meeting in London. "Some Tests on a Two-Stroke Cycle Oil Engine." Paper by Professor E. A. Allcut, M.Sc.

MAY 26.

Royal Metal Trades Pension and Benevolent Society:—Festival Dinner in London.

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Secretary: K. S. Bridges, Avenue Chambers, Southampton Row, London, W.C.1.

The American Arbitration Bar as an International Standard.

On February 6 this year we wrote in this column a rather sarcastic article on the Report of the American Foundrymen's Committee on Grey Iron Castings, because we assumed that an effort was being made by the American authorities to internationalise this bar. Mr. J. Shaw had received no answer to his technical criticism, and we deemed it of interest to awaken international appreciation of the British view point by forceful remarks, as the matter was definitely of interest to us as a great exporting nation.

We based our assumption of international application on the phrases, "This meeting was primarily for discussing the adoption of our International Test-bar," and "As a result of the letter of July 24 by letter vote the 1.2-in. dia. bar by 18 in. long was adopted."

In justice it should be stated that clause 11 enunciated that work was being carried out on the Fremont-Portevin method of testing. In the reply from the A.F.A. Committee it is pointed out that our assumption was wrong, so we may presume that they are still prepared to discuss the I.B.F. bars as an international means of specifying and obtaining metal of definite quality. Additionally, the answer draws attention to the assumption that the bar is only to be indicative of metal in the ladle. That assumption is untenable unless the British provisos—and these very considerably amplified—are accepted. Any second-year metallurgist knows that the bar *can only* represent the metal in the ladle provided that metal is poured under similar conditions to the bar. To take the case *ad absurdum*: From one ladle of metal there could be cast (a) a 12-in. cube in loam, (b) a ½-in. chilled rod, and (c) a 1.2-in. dia. bar cast under the old American Arbitration Bar conditions. So long as the material fell within the range of alloys known as cast iron we are prepared to state that the 1.2-in. dia. bar would not represent the metal in the ladle, except it be cast under approximately the same conditions. We consider that clause (5), section (f), of the A.F.A. Committee Report, if properly investigated, should give results so convincing that the British would have to enlarge their number of bars and state their cooling speeds with the greatest accuracy. This clause states when recommending procedure that "Factors shall be determined to correlate these various diameter test bars to the 1.2-in. dia. strength." These factors are well known. They are for any given composition—*rate of cooling*, with which is to be associated the proportion of combined carbon to the graphite; the higher the former, the stronger, and the higher the latter, the weaker. A second detached factor is the form of the graphite. It is to be noted that the recommendation to correlate results with the 1.2-in. bar *was apparently made before a single bar was broken*. However, as these tests are merely for American domestic testing they lose much of their international interest. From our point of view and in light of the American Committee's reply we feel justified in classing the Arbitration bar as a shop test. The bars used to check temperature in basic open-hearth practice are standardised only so far as each individual shop is concerned, and the results given are insufficient to prevent the "carpetting" of a melter when he casts at the wrong temperature. The exhibition of the bar is certainly some evidence of the heat of the bath. The breaking of an arbitration bar is certainly some evidence of the quality of the metal, but not much. The surface of the ingot or the condition of the ladle is more

reliable in the first case, and a carefully-conducted chemical analysis, coupled with a few microphotographs in the second. The scientific method of solving the first problem is the perfecting of pyrometers, and in the second case the production of test bars so as exactly to reproduce the conditions existing in the average section of the casting, always aiming at a method which will ensure that the smallest possible structural differences exist between the largest and the smallest sections.

Since writing the above we have had the opportunity of discussing the matter with Mr. Walter Wood, of Philadelphia, who is a member of the Committee referred to. Mr. Wood enunciates the following:—(1) That international agreements on technical aspects are worth while; (2) if arbitration bars are cast from every ladle of metal under standard conditions, then information is available for the engineer as to the quality of the metal used. On the first question we are whole-heartedly in agreement. As for the second statement, we are of opinion that if no reference is made to the casting itself, then there is a tendency to use metal giving good tests under the 1.2-in. dia. test conditions. Again, using an iron of the borderline compositions, it is conceivable that it may yield a white iron bar to represent a grey iron casting. We feel that, whatever is ultimately decided, the bar must be cast under similar conditions to the casting, and possess the same thermal history throughout.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Semi-Steel.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—A paper by Mr. H. Field was published in your issue of April 9 in which he refers to a paper I presented at the Milwaukee convention of the American Foundrymen's Association during their 1924 convention. His paper was a discussion on semi-steel and he disagrees with the results found in my investigations.

Mr. Field states that there is no carbon absorption by steel when melted in a cupola until after

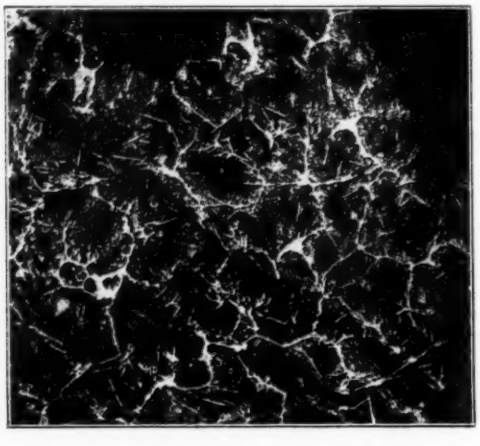


FIG. 1.

it is melted. He said that in no case did he find any carbon absorption in the partly melted steel found in the cupola drop. He did state that there was a thin edge of microscopic thickness which he did not consider. My results were similar to his and the difference in results reported lies in this microscopic thickness he dismisses as of no importance.

If carbon was absorbed it would be similar to the case hardening process which is so commonly used to put a hardened surface on low-carbon steel. The atmosphere in a cupola is an oxidising one to solid iron, so there can be no carbon absorption until the melting point is reached. The ability of iron to absorb carbon is greatly increased by partial fusion so the next possibility in absorption of carbon would be during melting. Due to the fact that an absorption of carbon lowers the melting point of the material, the iron that absorbed the carbon would have a lower melting point than the rest of the piece and melt and run off.

The two photomicrographs, Figs. 1 and 2 show the thickness of the case on a piece of steel taken from the cupola when the piece was reduced to

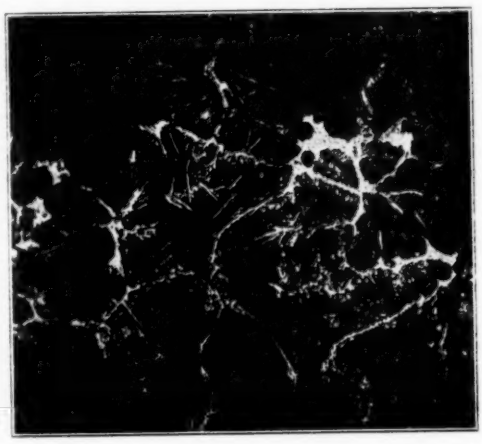


FIG. 2.

half its size. The two photomicrographs were from the same piece but from different locations. The black portions at the top are the outside of the piece. The magnification is one hundred diameters thus giving a high carbon steel of at least four one hundredths of an inch thickness on the outside of the piece.

One photomicrograph (Fig. 2) shows a band of pearlite between the high carbon outside of the piece and the lower carbon centre. Fig. 3 shows the structure of the centre of the piece. A large number of pieces was examined, and where there was a reduction of the size of the pieces from melting there was evidence of carbon absorption similar to that shown in Fig. 1 and 2. A pearlite band as shown in Fig. 2 being found in all where the reduction was large. In some cases where the signs

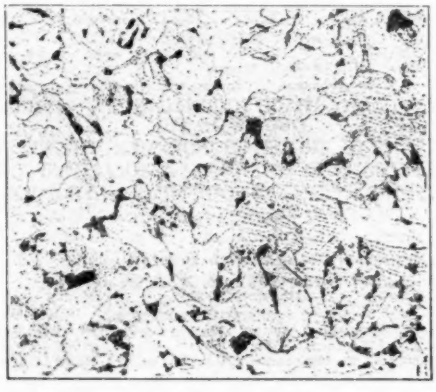


FIG. 3.

of melting were slight the outside of the piece was composed of pearlite.

The same question of carbon absorption was discussed by Mr. S. J. Felton in a criticism of the A.F.A. paper, and he put forth an argument to show how the carbon absorption was underestimated, that in the melting process there was more carbon absorbed than shown, but the resulting richer carbon mixture melted and ran off the piece.

Yours, etc.,

JOHN GRENNAN.

The University of Michigan,
Ann Arbor, Michigan, U.S.A.
May 1, 1925.

Making a Large Weighbridge Top.

By Henry Rice.

Almost all foundries have a particular class of work in which they specialise, and for which they lay themselves out to get the maximum from the plant at their disposal.

Many jobbing shops, however, are called upon to make work for which they have no tackle, and to make special boxes and patterns is out of the question. The specifications of the job under consideration do not call for the casting to be

Fig. 1.

observed, so long as it is free from scabs and blowholes, and many shops cast such tops open.

The pattern is a section, or, in the foundry phrase, "duckboard," which entails an enormous amount of work, what with coke bed and bedding in, sprigging and venting, also the amount of

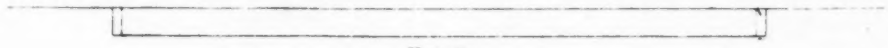


Fig. 2.

risk—even when all care is taken of washing, etc., is too well known to the moulder.

The writer describes in the following a more modern method of producing a top that will be equal to a dry sand mould at 50 per cent. cheaper than the old method.

A bed is struck up in the usual way by two parallel straight-edges (winding strips) on the levelled floor for their longitudinal direction, and set in transverse relations with two other parallel strips; this bed must be absolutely level, as on this the proper thickness depends, as shown in Fig. 1. The size of top required is then determined by the size of the rough frame which is placed on the strickled bed, which should be made adjustable, so that it may be used for any size required, and the sand rammed against its outer edges, to form the walls of the mould, as shown in Fig. 2.

The thickness of the top is determined by cutting cutters or flow, off each side of the mould, as shown at (*a*) in Fig. 3. As it is difficult to stop pouring when the mould is full, this will overcome the danger of getting the top too thick.

A core box having been made and mounted upon a "Samuelson" or similar turnover moulding machine, as shown in Fig. 5, the cores are then stuffed up with one core iron across the centre, with two lifting eyes in, for lifting into mould as shown at Fig. 6. Sufficient cores are then made of the following composition:—20 parts sea-sand and 1 part Glyso or other similar preparation.

The interior being filled with coke furnace

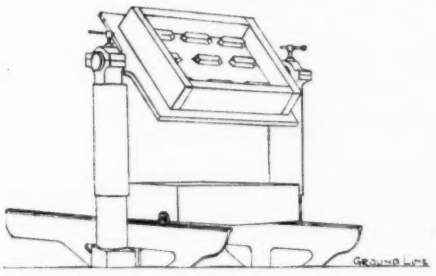


Fig. 5.

refuse in order to leave a 2-in. face all round, the cores should then be dried at a temperature of about 350 deg. F. (175 deg. C.).

If the tops are heavier than 50 cwt. the writer would recommend 18 sand to 1 Glyso, as the greater the quantity of binder used, the greater

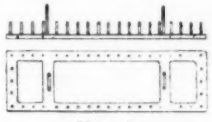


Fig. 6.

will be the resistance to the metal. When dried the cores are then assembled and placed in the

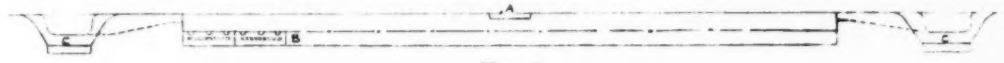


Fig. 3.

mould, as shown at (*b*) Fig. 3. A slab of the core is then placed in the basin of the runner, as shown at (*c*) Fig. 3. Fig. 4 shows a full view of the mould with one core in position, but when all the cores are in position, weights or pieces of pig are placed all round the mould, as shown at (*d*) Fig. 4.

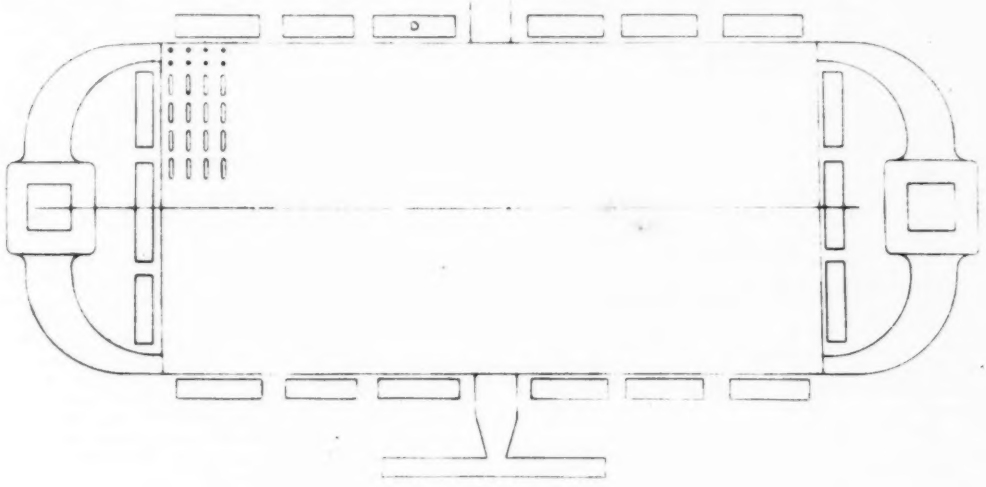


Fig. 4.

When the mould is all cored and passed as satisfactory by the foreman, nothing remains but the actual casting from molten metal at a fairly high temperature, which is to be poured from both ends, as shown at Fig. 4.

Upon the metal beginning to set, a sprinkling of sieved sea-sand is thrown all over the surface, and when thoroughly set it should be crossed to prevent its going caty-cornered. On removing

from the mould the casting should be brushed and any pieces that may not have been skimmed off, removed. A wash-over of thick blacking, with a good handful of core-gum added, gives it the appearance of a casting that has been covered in.

In conclusion, the writer would point out that it is not necessary to have skilled men on the job, since there is no risk of wasters providing the instructions have been fully observed.

Book Review.

French-English and English-French Dictionary (Technical). By J. O. Kettridge. Published by George Routledge & Sons, Limited, Broadway House, 68-74, Carter Lane, London, E.C.4. Price 50s. net.

This work, which contains the translations of 100,000 words, is a thoroughly substantial work, and the author, who has carried out the work unaided, is to be congratulated. We have thoroughly tested it so far as foundry terms are concerned, and it has not really failed us. Certainly the limited phrase "down sand frame" is not given, but, working from the French, a satisfactory equivalent could be found. All such words as "git," "down runner," "vent," "strip," "strickle," are excellently translated. We were particularly pleased with the equivalents for the word "scrap," as we have found that the terms used in France vary geographically. For instance, in one steel works "bocages" was confined to ingot-mould scrap, which constituted the only type of cast-iron scrap used in the works. From Mr. Kettridge's works, he rightly expands the term to include all cast-iron scrap, but we still imagine from practical experience that this word should be limited to heavy scrap, but again the application of the term may vary geographically. An innovation—so far as we are aware—in dictionary use has been the incorporation of a telegraphic code. This has been done in such a way that the decoding and translation is one operation, and additionally, the suffix of a coded word acts as a check to the references used. One of our translating staff deplores the absence of sketches. These, of course, can be of the utmost utility, but, after all, the major portion of technical translation is carried out by technico-commercial men, to whom a sketch means little or nothing. We believe the value of sketches in technical dictionaries has been over-stressed, because, primarily, when an item can be drawn, definitely equivalent words can be found. It is such practically synonymous words as slag, dross, and dirt which cannot be explained graphically where difficulties can arise. To refer to "dross" inclusions would be understandable but unusual. Mr. Kettridge has given a very sensible note on this subject when dealing with the three French words "scories," "laitiers," and "crasses," but, in our opinion, has been insufficiently definite in the translation of the word "decrassage," which is just "slagging off" a furnace, and has nothing whatever to do with stirring. The dictionary is one which can be definitely recommended to the engineering profession as a thoroughly workmanlike book of reference.

The Plasstick Competition.

The General Refractories Company, of Sheffield, announce that prizes ranging from £40 down to £2 have been awarded in the following order:—Mr. Harry Tickle, 66, Nag's Head Road, Ponder's End, Middlesex; Mr. H. Longley, 24, Walton Road, Sheffield; Mr. E. Longden, 80, Regent Road, Handsworth, Birmingham; Major Rhydderch, Abbeydale Foundry, Sheffield; Mr. W. H. Coles, 2, Gordon Avenue, Norton, Sheffield; Mr. R. Village, 161, Abbeyfield Road, Sheffield; Mr. G. Roberts, 149, Sharrow Vale Road, Sheffield; Mr. W. S. Sixsmith, of 6, Gloucester View, Armley, Leeds; Mr. L. J. Tibbenham and Mr. E. Morton, of Suffolk Foundry, Stowmarket. We were not surprised to read in a personal letter from Mr. Frank Russell, the managing director, that the money has been well spent in getting a real appreciation of the users' viewpoint, and no doubt the pointers outlined will be incorporated in the make-up of the plastic refractories of the future.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Microscope as a Foundry Adjunct.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—When reading the interesting discourse of Mr. J. S. Primrose, I was struck by the remarks of Mr. S. G. Smith, reported as follows:—

"He was pleased that Mr. Primrose had given to Dr. Sorby the credit for the discovery of this pearlitic structure. So much had been said about pearlitic cast iron in Germany, that some people might get the idea that it originated in that country. All cast iron, he believed, had a pearlitic structure more or less, and he did not quite know what was meant by 'perfect pearlitic structure.'"

Mr. Smith may rest assured that Dr. Sorby's work is known and recognised the world over and that the Perlit process is another matter altogether.

Unconsciously, perhaps, Mr. Smith himself provided the key to the whole situation. He said. *all cast iron has a pearlitic structure more or less.* Thus is demonstrated the great value of the Perlit iron which has a pearlitic structure to which there is no need to add the disastrously limiting description of *more or less.*

Yours, etc.,
H. J. YOUNG.

16, Ashfield Grove, Whitley Bay,
Northumberland.
May 18, 1925.

The Refractories Association.

A well-attended meeting of the Refractories Association was recently held at the Central Station Hotel, Newcastle-on-Tyne, and on the following day, by courtesy of the Consett Iron Company, Limited, a visit was made to the new silica brick and firebrick works at Templetown, Consett. The party were welcomed by Mr. A. H. Middleton, the general manager of the brickworks and coke ovens, who expressed his pleasure at receiving his fellow members of the Refractories Association. The party was conducted round the works, and the well-equipped plant and the excellent products were greatly admired. The works are designed on the most up-to-date lines, and the whole layout was most favourably commented on. After inspecting the brickworks, the laboratories were visited, and the party were entertained to luncheon. Mr. F. J. Boam (the President), in proposing the toast of the "Consett Iron Company, Limited," thanked them for their courtesy and hospitality.

After luncheon, the new battery of coke ovens, which are constructed of Consett silica throughout, was visited, and the visit concluded with an inspection of the new steelworks.

Catalogue Received.

Trucks.—We have received from H. C. Slingsby, of Bradford, their List No. 271, which contains 32 fully illustrated pages. This catalogue is of the useful as distinct from the artistic type. It is printed on art paper in red and black, and for some (we presume business reason) every illustration is over-printed in red with the name, "H. C. Slingsby." The catalogue has been prepared for the Printers' Exhibition, and if our copy is a fair example it is quite likely to be adversely criticised from a printing point of view. The catalogue is of real practical character, and one that will, no doubt, be consulted with interest by works managers.

A MEETING of the Council of the Foundry Trades Equipment and Supplies Association was held at the offices of the Association, Avenue Chambers, Southampton Row, London, W.C.1, yesterday week, the President, Col. W. F. Cheesewright, D.S.O., presiding. The object of the meeting was to regularise resolutions made before the Association was registered.

Extending the Uses of the Oil-Sand Core.

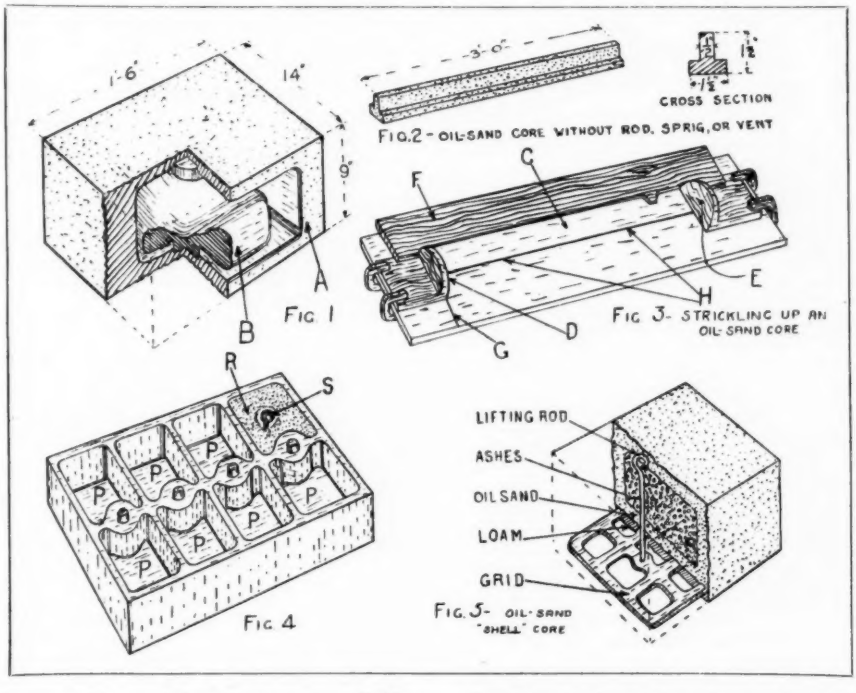
By F. C. Edwards.

The general superiority of the oil-sand core over the ordinary dry-sand core is now established beyond the pale of argument. Everyone knows that with oil-sand cores both venting and core irons are almost entirely dispensed with, and that, as a consequence, such cores are simpler and less expensive to produce. It is also common knowledge that, without its aid, some of the best classes of foundry work to-day—motor cylinders, for instance, would be impossible of accomplishment.

This universal realisation of the advantages of oil-sand cores must inevitably lead to their universal adoption. And even the ultra-conservative foundry man will be compelled, sooner or later, to make use of this, the most revolutionising factor, perhaps, in modern foundry practice.

Now, one of the primary, if not, indeed, the very foremost of the functions of the Institute of British Foundrymen is the dissemination amongst its members of the latest tried-out methods relating to the pursuit of their craft. The benefit accruing to the industry generally, and to the members of the

Some mixtures are better adapted for certain classes of work than others. Actual tests will best determine their fitness. Consequently, it is unwise to conclude, from a trial of one mixture alone, that oil-sand cores are unsuitable for any given job. That this is sometimes the case may be assumed from a remark recently made by a very competent foundry manager of long experience. This gentleman happened to be in the core shop of a foundry that had obtained an order from his own firm for certain high-class castings. On every hand he found oil-sand cores being made. Turning to the foreman in charge, he remarked: "I should not use that stuff; we require a very good face on *our* castings"! Evidently, his experience of oil-sand cores must have been somewhat limited. It may be added that subsequent inquiries elicited the fact that his own foreman coremaker—although very capable with the old methods—was lacking in that spirit of enterprise and initiative which, to-day, is quite as essential for success in the foundry as it is proved to be in many other walks of life.



I.B.F. in particular, of shorter or more reliable cuts to maximum production largely depends, of course, upon the undelayed freedom of access to the new field.

The exploitation of the possibilities of the oil-sand core furnishes a typical case in point. This comparatively new and versatile foundry auxiliary increases in value as it becomes more and more understood. It is found to be something besides that of just a substitute for the dry-sand core. It has its own peculiar virtues, with a very extensive, almost unlimited domain. It may, indeed, be regarded as a species by itself. Its most complete utilisation, therefore, lies in the consideration of its ever-widening possibilities, and in the broadcasting of its behaviour in the various situations in which it has been successfully employed.

In extending the uses of the oil-sand core, an "open mind" is vitally essential. It is also important to remember that there are oil-sand cores *and oil-sand cores*. The generic name, as we may call it, covers the original mixture of linseed oil and sea sand with the respective proportions, by weight, of about one in forty—as well as those innumerable proprietary mixtures of gums and glutens which bear more or less descriptive names.

* A Paper read before the Birmingham Branch of the Institute of British Foundrymen, Mr. T. Vickers presiding.

In spite of the advice above referred to, however, oil-sand cores were not only used extensively for the cores themselves, but were also employed in forming certain parts of the actual moulds. And it is only fair to add, in vindication of the course adopted, that when the castings were delivered, the sceptical foundry manager declared that he "had never seen better looking castings."

When Surface Roughness Helps.

Such a gratifying result was not achieved, of course, by using the plain linseed oil and sea-sand mixture alone. It must be admitted this leaves a comparatively rough surface on the casting. An important point in its favour, however, is that it possesses in a higher degree than many of the proprietary mixtures the virtue of being able to withstand the effect of moisture without collapsing. Such cores may be built in a green-sand mould, in the early stages of a job, without any risk of their disintegration by the humidity of the mould. Fig 1 illustrates a type of double core, which is frequently built in green-sand moulds several days before casting. The outside core, A, is made in two parts to enable the inner core, B, to be inserted in its place. When assembled, the double core is placed with its open side against the pattern—being positioned by gauges—and the whole is then rammed up as simply as ramming a brick.

The plain linseed-oil core, again, is ideal for "adjustment loading holes" in "weight" castings. Here a slight roughness of the surface is obviously an advantage; it helps to retain the lead by which the casting is subsequently loaded up to its exact weight. Moreover, although these cores are regularly placed in the green-sand mould, suspended from the cope, several hours before casting, they remain quite unaffected by the surrounding moisture. In the smaller size weights the cores are but ¼ in. thick by ½ in. wide, and 1 in. long. No vents or sprigs whatever are used. It may be of interest to mention that these cores are made from a plate containing about a hundred slots. Each slot is a core-box. A boy can make from twenty to thirty plates of cores an hour—that is, from 2,000 to 3,000 separate cores.

This is a great improvement in every way over the dry-sand core. There is a gain in speed comparable, may we say, to that of the aeroplane over the cab horse. And the cost of production is very considerably reduced. Furthermore, the cores fall away quite freely from the castings; there is no need even for shaking. The oil bond being completely consumed, nothing remains to hold the sand together, and so the castings are left perfectly clean inside.

Moisture Considerations.

The disqualifving feature—for general work, at any rate—of the plain linseed oil and sea-sand core, however, is that it easily collapses when green. This seriously militates against its use for anything beyond the flat variety of core, that is where the cores are completely supported on the drying plate. And even in the latter case, any but very shallow cores are liable to shake to pieces as they are being transported to the stove. Such a core as that shown in Fig. 2, for instance, would be altogether impossible out of the linseed oil mixture, on account of its depth and length.

Fortunately, there are certain proprietary mixtures from which any shape of core may be made, and which leave an excellent surface on the castings. It would, of course, be invidious, if not entirely out of place in this paper, to mention any of these by name. And, in any case, it is perhaps better for the foundryman to ascertain at first hand which of the various brands give the most satisfactory results when applied to his own particular class of work. With some brands, it may be mentioned, the cores, though possessing certain good qualities, are not quite so impervious to moisture as other brands; consequently their employment is somewhat restricted. Others are not only moisture-proof, but they also impart a nice smooth surface to the castings. In addition to these qualities they permit beads and projections to be formed on the cores (which with dry sand would require sprigging) without any re-inforcement whatever.

Oil-Sand Shell Cores.

With the larger type of dry-sand core—those for which expensive core irons would ordinarily be required—there is a very wide and profitable field for the employment of oil-sand cores. Two or three loose crossed rods, through one of which a hook can be inserted for handling the core, obviate the need for grids in the case of cores up to, say 3 ft. square and several inches deep. Even in the largest jobs the simplest of grids will usually suffice.

Take, for instance, a rectangular, block core, as shown in Fig. 5. The oil-sand method is as follows:—Upon a plate sufficiently large to carry the core, loam is spread to a thickness of about one inch. Over this a plain grid without prods is laid. The loam is made up to the top surface of the grid. When dry, the grid carrying the slab of loam is turned over, and the latter is well blacked on the lower surface. This, by the way, saves a crane-handling operation of the heavy core later on. The loam plate is returned to its original position—that is, blacked side down, and the core-box positioned over it. The bottom and the sides of the box are then lined with from 3 to 4 ins. of oil sand—like paste round a pie dish. The sides are built up by the aid of a board supported at the back by weights. The middle space is then filled in with ashes to within 3 ins. from the top of the box. This is finally filled up with oil sand. One night is sufficient to dry such a core in an ordinary core stove. With regard to venting, it may be added that beyond the accidental virtue in this respect of the body of ashes in the centre of the core, no provision whatever is made for the escape of gases. A vent wire is not used at all on the job. Further, only one side of the core opens out into a point. The other sides are enclosed by metal of 1½-in. thickness.

It will be seen from Fig. 5 that the above described core is really in the nature of a shell. Herein lies one of its incidental advantages over the ordinary dry-sand core. The shell quickly collapses in the casting. Moreover, since the grid carries no prods, the core is removed in a fraction of the time required in the case of the ordinary dry-sand core.

It may be well to observe here, that where small cores are inserted in large ones, or in large dried moulds, they should not be placed in position until the latter are dry; if this order is reversed, the small cores will be burnt by the heat required to dry the large cores or large moulds.

Now, the foregoing remarks largely refer, of course, to the superior merits of the oil-sand core considered as a substitute for the dry-sand core. But the object of this Paper is to indicate, from actual cases, how the uses of the oil-sand core may be extended beyond those usual—or even possible—with dry sand. And how, by its aid, some of the work that is now, with more or less difficulty, done by the moulder, may, quite easily, expeditiously and economically, be carried out in the core shop.

Replacing Cylindrical Loam Cores.

Let us consider, first, how the oil-sand core may be employed with advantage, both in speed and economy, in the place of certain cylindrical loam cores. Here, with new work, the expense of a loam barrel is saved, as well as that of fibre or hay band. No roughing or finishing is required (which in the case of loam cores, usually necessitates two or three nights' drying), but one operation, and one night's drying in an ordinary core stove will usually suffice.

Take, as an example, the case of a core, ordinarily made in loam, say 12 ins. in diameter and 7 ft. long, with a reduced neck, similar to that produced by the projection on the strickle board, F, in Fig. 3. The sketch shows plate, C, and guides, D and E, and strickle F, in position for strickling up a half-core in oil sand. The *modus operandi* is as follows:—

A centre line, H, is marked along the iron plate, C, and another line, G, is laid down at right angles to H. Guide D is then securely clamped down at the end of the plate with its inside edge on the line G. Guide E is then positioned at the opposite end of the plate by means of the board, F, and a set-square. This guide block is also clamped in position. The oil sand is filled in between the guides, and the core is strickled to shape by the board F. It will be seen that the board is rotated, not the core. The guide blocks are then removed and the core is stoved on the plate. The other half-core is similarly formed. When dry, the two half-cores are jointed and gummed together, or, if considered necessary, a more secure means of holding the half-cores together may be adopted. Rods and hooks could be embedded in each half, and the two firmly bolted together.

If several identical cores are required, the guide blocks may be cast on a specially-made plate. In this case the cores would be turned out into a frame. This would simply involve a rough wooden frame being made a little deeper than the core, and large enough to surround it. The frame is placed over the finished green core and is filled up with black sand. The core is embedded out and stoved.

The question may arise, how is such a core to be secured in case it is required to be anchored down in the drag? The answer becomes clear by referring to Fig. 6. Here a rod, J, carrying a crossbar, K, through the buried end loop L, is built in the core. When the two half-cores are pasted or bolted together, another rod, M, may be passed through the loops N in each half-core respectively—as through holes in the end of an ordinary core barrel—and thus secured to the box part.

It is, indeed, not too much to say that there is

less risk of an oil-sand core getting away when secured in the manner above described than is entailed in the case of a loam core on a barrel. For in the latter case, although the core barrel may be firmly held to the bars of the box part, the core itself might become loosened from the barrel by the hay band, for instance, becoming overheated. The core then would be in imminent danger of being forced upwards—slid along the barrel—by the hydrostatic upward pressure of the metal, a foundry phenomenon that does happen occasionally. Finally, with the oil-sand core there is no hay band or hollow barrel to tempt the molten metal to play any mischievous pranks as the job is being poured.

The above example of oil sand replacing loam cores is capable of many variations in which the work of the patternmaker and coremaker may be greatly simplified and the cost of production materially reduced.

The most striking successes of the oil-sand core are undoubtedly those in which it has superseded certain moulding operations. Here the field for its profitable employment is very extensive. In the replacement of mould cods, for instance, that are usually lifted in the cope, it is particularly helpful to the moulder.

Replacing Mould Cods.

A simple case of this description is illustrated by Fig. 4. The job is moulded and cast face downwards, as shown, in order to ensure a clean surface for machining. Ordinarily, of course, special grids would have to be made for this type of job, to carry

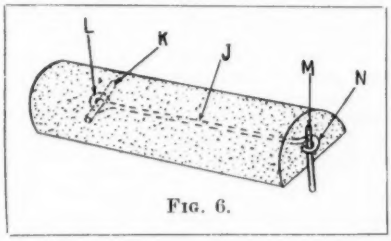


FIG. 6.

the cods formed from the spaces, P. This would take a day or more, depending upon the size of the job, before moulding proper could be proceeded with. This would involve both delay and expense. Moreover, in some cases, owing to the shape of the casting, such as the presence of internal flanges, etc. (not shown), which might possibly necessitate the destruction of the grids in order to remove them, one would have to make a new set of grids for every casting. Now, thanks to the oil-sand core, such a job may be successfully negotiated without resorting to special grids or lifters. In this way moulding is simplified, time is saved, risk of scabbing is practically eliminated, gas troubles are diminished, and the casting costs less to produce.

In the example illustrated by Fig. 4 the spaces, P, are treated as though they were so many core-boxes. From these, oil-sand cores are made as follows:—A little oil sand is spread over the bottom of each space. Upon this two or three crossed rods are laid for the reception of the lifting hooks by which the cores are suspended to the cope. The spaces are then filled in with oil sand. A core is seen in position at R, with lifting-rod eye, S, for attaching to the cope. With the larger spaces, of course, ashes would be used for the centre of the core to economise oil sand.

The whole is then covered with a plate, the job is turned over, and the cores removed on the plate to the stove. When the moulder is ready to ram up the cope, he places the cores back in the pattern in their respective spaces, and by means of the loops, S, already fixed in the cores, he secures each core in turn to the box bars. The ramming of the cope is then quite a simple operation, in most cases merely that of an ordinary flat-top part, no lifters being required.

Then follows what is undoubtedly the greatest recommendation for the employment of the oil-sand core in this class of work. First, however, in order to arrive at a fair comparison, let us consider briefly the procedure necessary with the ordinary method where green-sand cods are carried on grids and lifters. In such a case, when the cope is removed, it is quite usual to find that most of the cods have to be repaired. The sand, especially in the corners and narrow spaces, is apt to remain behind in the pattern. Each damaged part therefore calls for a more or less amount of patching up, sprigging and re-venting. In the larger jobs this mending up may occupy a day or more; and each patch, however neatly executed, entails more or less risk of scabbing. The latter danger is, of course, largely a consequence of the necessarily imperfect continuation of the venting.

Oil-sand cores, on the other hand, withdraw from the pattern without injury. The time necessary for finishing the cope is thus reduced from, say, several hours to as many minutes. In most cases the moulder simply passes a rim tool or an upsett along the rib spaces between the cores to ensure close joints. Finally, there is no risk of scabbing, and the castings are easier to dress. Incidentally, it will be noted that the above method of ramming the cope from the cores possesses an advantage over that in which the cores are bolted to the top part into print impressions formed from the pattern. For the surface from which each core takes its vertical alignment in the mould—being formed from the cores themselves whilst in their exact location—fixes, and maintains each core in its respective relative position.

Pattern Shop Co-operation.

This part of the subject brings into prominence the necessity of pattern-shop co-operation in extending the uses of the oil-sand core. In the case of Fig. 4, for instance, where a number of similar pockets appear in the top side of a pattern, as moulded, the ribs, etc., need not be tapered or finished, as is usually the case. Neither is it necessary to put fillets in the corners of the spaces. All that is required is a core box the size of one space, and a loose boss to produce the varying cores. In this way not only is time saved on the pattern itself, but the cores are obviously easier to make out of a box than from spaces in the pattern. It should be observed that as these cores tend to swell laterally in drying, the core box should be made slightly less—say one-sixteenth of an inch all round—than the spaces in the pattern.

Applications Enumerated.

The oil-sand core makes for economy in the pattern shop by the fact that core boxes last a great deal longer when used for oil sand than for dry sand. It should be noted, however, that the ends of the boxes are usually best closed. This enables the core maker to use both hands for pressing the sand in the box. It is also an advantage, where practicable, to make the open side of the box flat. The core may then be turned out on to a level plate. The simplicity of the operations involved in making the oil-sand core is often the determining factor in cases where deep jointing or drawbacks are the alternatives. Especially is this the case where a number of castings are required from the same pattern. Where the difference between forming a deep joint in the mould and making a dry-sand core would not, perhaps, be sufficient to justify the expense of a core box, an oil-sand core, being much simpler to produce, turns the scale in favour of a core. This not only saves much work in jointing and mould repairing, but also ensures more uniform castings and reduces scrap. Oil-sand cores, again, form a perfect substitute for the loam plate, such as is built in a mould over lugs, etc. From a plain frame core box a pile of such cores can be made in a fraction of the time—and of course at much less cost—than it would take to daub dry and black loam plates. The oil-sand cake possesses the further advantage in that it may be sawn up and shaped by the moulder to a far greater extent than would be possible with a loam cake. It is firmer to handle in small pieces. Another use for the slab form of the oil-sand core is that of its employment at the bottom of downgates. It is found to withstand the impact of the metal very effectively.

From the above examples—which cover, of course, but a fraction of the ground explorable—one may safely assume that as confidence in the oil-sand core grows, so will its uses be correspondingly extended. Here, as elsewhere, it is the

first step that counts. The pioneer spirit is essential for success. Given a fair trial, the oil-sand core will prove its *raison d'être* in large or small foundries. Incidentally, it will demonstrate that although the foundryman may be notoriously conservative he is also pre-eminently practical. Though he may start with a strong bias against the use of the oil-sand core, he is bound, ultimately, to reach the conclusion enunciated by a certain very competent moulder who, after condemning it (without trial, of course) finally admitted, when he found that it saved him a great deal of work in top finishing, that "there was something in it after all." The same moulder, it may be added, is now one of the strongest advocates of oil sand. He is quite expert in sensing its application whenever a suitable opportunity presents itself, and he insists upon cores being made from spaces the cods of which would otherwise have to be lifted in the cope.

And now, in conclusion, what of the coremaker, the individual most immediately concerned in this matter? Does his job become better, or worse, by extending the uses of oil sand? Decidedly better. His status is bound to improve as his services are increasingly requisitioned. Then again, with oil sand the need for laborious, hard ramming becomes a thing of the past. And no one can deny that oil sand is far healthier and infinitely more pleasant to handle than manure mixture, or the cold, sloppy loam, especially where girls are employed in coremaking. Naturally, when it is first introduced, being something new and more or less mysterious perhaps, it may have to run the gauntlet of opposition usually attendant upon the introduction of new things into a conservative environment. But when the coremaker realises how much simpler his job becomes by employing oil sand, and how by its use he may bring the art of coremaking to a pitch of perfection hitherto undreamt of, he will demand more and more oil sand.

Standardised Power Transmission Appliances.

The keynote to economical production is no doubt standardisation, as it offers the one and only means for obtaining mass production. All users of power transmission, large or small, cannot but be interested in the latest development of Crofts (Engineers), Limited, of Thornbury, Bradford, which is nothing less than the standardisation of practically every power transmission appliance. It is certainly the greatest development in the manufacture of power transmitting machinery in this country, if not in the world. We have received an advance copy of the new catalogue, which will shortly be released by the firm, and one has only to glance through it to realise how great the undertaking has been. Amongst the many appliances listed (upwards of 100 as a matter of fact) mention may be made of variable speed gears, right-angle drives, reduction gears, friction clutches, pulleys in endless variety, plummer blocks, wall plates and hangers of all types, ball and roller bearings, couplings and bright turned shaftings in all sizes from 1 to 8 in. diameter and in lengths up to 30 ft. To meet the requirements for shafting alone means carrying a stock of 2,000 tons. Delivery is guaranteed from stock of the whole of the appliances listed. The first installation of the Schurmann cupola in this country has been erected at the works, and the latest type of Sandslinger is in regular operation, thus bringing the foundry practice in line with the most modern developments.

The Pluto Stoker Company have removed from 2, Upper Westbourne Terrace, London, W.2, to Lonsdale Chambers, 27, Chancery Lane, London, W.C.2.

Mr. H. Lewin, formerly of the Sheepbridge Works, has just terminated a three years' contract as Inspector of Castings under the Government of India, and has now accepted the position of general manager of the Eastern Light Castings Company, Limited, Kulti, India.

Discussion on "'Peeling' in White-Heart Malleable." *

Prof. T. Turner said the authors were correct in stating, in their third conclusion, that the rate of heating to the annealing temperature has a great influence on peeling, and this was a factor which could be controlled when dealing with pure materials. Commercially, however, we have to deal with impure materials and, particularly in England, we have to deal with cast iron which is very rich in sulphur. He often wondered why we employ cast iron containing about 0.35 per cent. of sulphur, unless it is that that is the only iron that is on the market. Presumably it was white iron made in the blast furnace which was said to be refined in some way. The Americans used iron with much less sulphur, and there was no reason why we should not have an iron much lower in sulphur unless there were commercial reasons. He had experimented, however, on the influence of sulphur on the mechanical properties, and had been able to show that within ordinary limits the mechanical properties do not appear to suffer and that was, no doubt, why malleable iron founders are still content to accept a high sulphur-content. At the same time, this high percentage of sulphur introduced another variable and another possibility of error. The question of what is the effect of sulphur was interesting. He himself had shown a number of years ago that the presence of silicon in cast iron diminished the solubility of iron sulphide and tended to throw it out of solution. That was in accordance with the suggestion of the authors, viz., that when the silicon is high the greater will be the liability to peeling. The interesting point was that the amount of sulphur which passed out in solution was relatively small because there was nearly as much sulphur left in the malleable cast iron as there was in the original pig-iron. Percy showed half a century ago that sulphide of iron and oxide of iron can exist side by side and can be heated without any reaction taking place. At a still higher temperature towards the melting point of iron, however, reaction does take place and sulphur dioxide would be given off and less sulphurous iron remains. This suggested that the acceleration of peeling by means of sulphide of iron was due to the fact that at about the temperature where this peeling was accelerated, the sulphide of iron is mobile and more readily oxidised than the iron itself, and the oxide of iron and the sulphide of iron, more or less in mixture, would be present together and help to form the peel. There was still, however, a further question to be considered, viz., the influence of the carbon on the sulphide of iron. The authors had spoken of the combination of the carbon and its effect on the peel, which was no doubt an important one. It was known that the graphite separated from ordinary cast iron, when examined chemically, was always found to contain more or less sulphur, and that led to the suggestion that there was some sort of combination between the iron sulphide and the carbon, and he wondered whether there is an iron sulphide-carbon eutectic at a high temperature in the same way that there is an iron phosphide-carbon eutectic. On that point there was no evidence, but if there was such a substance, no doubt it would have an influence on the reaction.

Dr. W. H. Hatfield said that peeling of the surface of malleable castings was extremely well known to everyone engaged in the industry, and the work done by the authors and their conclusions were in line with the conclusions he himself had arrived at in an empirical sort of way. He had never been able to satisfy his mind, however, as to the mechanism of the process. There was no doubt that high temperature and high silicon content were largely instrumental in producing peeling. Furthermore, the sulphur was high in all the old malleable castings, and one would take that almost as a constant in considering the process. There was a good deal in what Prof. Turner had said. There was very definite evidence, as shown by his own earlier researches,

* A Paper read before the Iron and Steel Institute. The authors were Messrs. Douglas H. Ingall and H. Field, and the Paper appeared in our last issue.

that sulphur and silicon can directly combine, forming sulphur silicide. That was also brought out by the very important researches of Dr. Stead 20 or 30 years ago. As to the point mentioned by Prof. Turner concerning the high content of sulphur in malleable cast iron in this country, the fact was that in Europe the only iron that was available until 20 or 30 years ago came from the blast furnace at the stage when there was a low silicon content and a high sulphur content. The malleable-iron manufacturer must have iron low in silicon, and therefore he put up with the sulphur, and he learned to make his malleable castings in spite of the high sulphur content. On the other hand, in America the iron had a low sulphur content and they were able there to produce an indigenous malleable cast iron. Now, in Europe, the same type of material is being produced. He did not believe that peeling would take place to the same extent and with the same ease with excessive heat and high silicon with the American blackheart iron as was the case with the European, and if the authors had not tried experiments in this direction, it would be interesting if they could.

PROF. W. CAMPBELL (Columbia University) suggested that a great deal depends upon the amount of manganese present in the iron in reference to the rate of oxidation of the iron sulphide. A point was whether we know why iron, containing iron sulphide, when heated changes its structure, in that the eutectic which was previously that of iron sulphide becomes a ternary mixture of iron, iron oxide and iron sulphide. The higher the manganese the slower this change takes place. Furthermore, with regard to the question of the effect of time and temperature, we must sooner or later make experiments to continue the old work of Schenck to determine the equilibrium between iron oxide, iron, carbon monoxide and carbon dioxide at temperatures below malleableisation. Somebody must find the time to determine the equilibrium at the temperatures at which we perform malleableisation.

DR. W. ROSENHAIN said that on the question of the various eutectics, which had been referred to rather freely, it was necessary to give a word of warning. Because iron and sulphur form a eutectic at a certain temperature and iron and phosphorus form another, it could not be assumed that corresponding eutectics will be found in a complex like cast iron. It was necessary to know a great deal more about the constitution of these complex systems. It was a long business to study them, but he hoped that in the course of a few years we shall know a little more about them. Until that time came, it was a little dangerous to draw conclusions, because the addition of further elements tended to lower the temperature at which these eutectics melt. As to cast iron high in sulphur, no doubt many of those interested in cast iron were aware that processes for de-sulphurising cast iron are now being very largely and successfully worked, although not, so far as he was aware, for the production of malleable. Modern work, however, confirmed Prof. Turner's point that the presence of sulphur does not appear to affect the mechanical properties of the iron very much. Investigators, mostly in Germany, had tried very hard to show that it does, but they had failed; but what they did claim was that a better and a sounder casting can be obtained. At the same time, if sulphur were undesirable, it was well to remember that there are methods for removing it, and, he believed, quite cheaply.

The Author's Reply.

MR. FIELD, who replied, said the object in doing the work was to help the small malleable iron founders, who were to be found chiefly in the Midlands district. The malleable iron industry was far behind the other branches in the iron industry in the application of any science or scientific methods whatever to its processes, and the object was, if possible, to produce a few simple rules which might be of advantage without delving too much into scientific reasons; to help some of those who, at the present moment, are undoubtedly struggling for existence in competition with steel and steel forgings. A great deal of the discussion had hinged around the question of sulphur. He believed that the difference between the sulphur content of the iron used for malleable work in this country and in America is largely due to the fact that in this country we melt our malleable iron in the cupola, whereas in America they melt it in the air furnace. Whilst we continue our methods in this country of having to re-melt 52 per cent. of scrap every time in runners and gates, it would never be possible to reduce the sulphur in the iron, even if we started with as low a sulphur content as 0.15 per cent., because by the time the founder had dealt with it and it had been melted in contact with coke, that sulphur would have risen to the region of 0.35 per cent. to 0.4 per cent. Therefore, we were prohibited from using the American blackheart until we adopted the open-hearth or air furnace for melting. It would never be possible to reduce the sulphur content whilst the cupola held sway for melting. He was very much indebted to Prof. Turner for his remarks with regard to the iron-sulphide eutectic, and if this work should be continued further, in order to elaborate a possible explanation of the peeling phenomenon, this matter would certainly be borne in mind. Personally, he believed there was a considerable movement of the sulphur within the material, not only outwards but throughout the specimen, because notwithstanding that in the specimens referred to in the Paper the sulphur content was uniform at the commencement, after annealing it was found that there was considerably more sulphur in the centre portion than was present on the average to begin with. The authors had not tried American blackheart, as suggested by Dr. Hatfield. As regards manganese, it must be remembered that any appreciable percentage of manganese retards malleableisation.

Personal.

MR. P. F. CRINKS, London sales manager of the Metropolitan-Vickers Electrical Company, Limited, has been elected to be managing director of Metro-Vick Supplies, Limited. Mr. Crinks was a pupil of Mr. H. Faraday Proctor, chief engineer and general manager of the Bristol Corporation Electricity Department, and was finally appointed commercial engineer. He joined the British Westinghouse Electric Manufacturing Company, Limited, in 1910, and for several years represented them in the western circuit. After being transferred to the London office he was appointed London sales manager for Metropolitan Vickers Electrical Company, Limited. He was one of the original members of the committee of the Western Centre of the Institute of Electrical Engineers, and is vice-chairman of the general committee of the Engineers' Club in London.

Wills.

WHEELER, R. A., of Westville Road, Cardiff, retired ironfounder	£12,907
HAYDEN, SIR HENRY, formerly Director of the Geological Survey of India	£2,889
CLARKE, J., managing director of Thomas Clark & Sons (Sheffield), Limited	£33,436
AUSTIN, S. P., a director and former chairman of S. P. Austin & Son, Limited	£123,683
WILLIAM JAMES, 1ST VISCOUNT PIRRIE, chairman of Harland & Wolff, Limited.	£707,785
DEADMAN, H. E., late Assistant Director of Naval Construction, some time director of Cammell, Laird & Company, Limited	£8,600
FIELD, C. E. F., late managing director of Matthew T Shaw & Company, Limited, Millwall, E., engineers and ironfounders	£10,341
STEWART, J. G., of Aultwharrie, Dunblane, N.B., chairman of Stewarts & Lloyds, Limited, and a director of the North Lincolnshire Iron Company, and Robert Addie & Sons' Collieries, Limited	£396,753

International Magnesite Cartel.—The latest report about this is that the American producers have refused to join the Combine. Moreover, the Californian producers have managed to secure preferential rates for their output on the railroads, and the U.S. Commercial Department intends to adopt protective measures for the home produce. The latest competitor is Russia; the first cargo of magnesite from the Urals has already been shipped to Antwerp.

Institute of British Foundrymen.

ANNUAL MEETING OF THE BIRMINGHAM AND WEST MIDLANDS BRANCH.

The annual meeting of the Birmingham and West Midlands Branch of the Institute of British Foundrymen was held at the Chamber of Commerce, Birmingham, on Thursday, April 30, the retiring President (Mr. Thomas Vickers) in the chair.

The Hon. Secretary (Mr. H. J. Roe) presented the 19th annual report of the Council, which stated that the year 1924-5 had been one of steady and continuous progress. During the year 28 new members had been elected, 15 members had been removed from the register, 7 had resigned, 3 had removed to other districts, and 3 had been transferred from other Branches to the Birmingham and West Midlands Branch. The total number on the register was 151. The work of the Branch being carried out in a very large area, the Council point out that the membership is but a very small proportion of the number of foundries in that area, and every step should be taken to increase the membership. The Council records with regret the decease of Mr. Robert Buchanan, who was the first President of the Branch from 1906 to 1909, and one of its most active members and supporters. Mr. Buchanan was one of the promoters of the Institute, and its first President in 1904. By his death the Branch has suffered a severe loss. They also record with regret the decease of Mr. E. Broughall, of Coventry, an old member of the Branch. The Council regret that by the removal of Mr. A. Parsons to South Wales they will lose a valuable colleague and the Branch an active member. In the early part of the session a visit was made to the Branch by Mr. R. Mason, of Australia, who was President of the Branch in 1909. During the year eight lectures had been held at Birmingham, and the Branch were invited to join four lectures with other local Societies. Six visits to works had been made, and five lectures had also been held at Wolverhampton, Dudley, Walsall, and West Bromwich for propaganda purposes. All the lectures and visits had been very well attended, and the discussions at the lectures had been of a high standard. The Council express their thanks to the lecturers for the Papers prepared. A very successful dinner and a social evening were held during the session, and were greatly enjoyed by the members who attended. The Council had carried out considerable propaganda work during the year for the purpose of increasing the membership. Although this had entailed a heavy expense upon the funds of the Branch, the Council believed that with the assistance of the members such work would ultimately bear fruit and increase the membership. With the consent of the General Council, the Council had decided to alter the name of the Branch to that of "The Birmingham and West Midlands," as they believed it would create a larger interest in the work of the Institute among foundries outside Birmingham. The formation of the Junior Section, as approved at the last annual meeting, had not yet been completed, owing to the inability of the Council to obtain the services of a secretary. The work had now been taken in hand by Mr. McKenzie, and the Council hope to start the Section at once.

The Council record with pleasure that Diplomas of the Institute were awarded by the General Council to Mr. H. Field and Mr. E. Longden for Papers read before the Branch.

In moving the adoption of the report, the PRESIDENT said the membership had not increased to the extent the Council anticipated, and reminded the rank and file that it was upon their individual efforts that progress in this direction rested. The programme of lectures was the largest arranged by any Branch, and evoked a great deal of interest. The lectures were well attended, as were the propaganda meetings held in various centres. Whether such propaganda meetings would be held next session depended upon the funds at the disposal of the Branch. In deference to the wishes of the East Midlands Branch, the General Council, with the approval of the Birmingham Branch, decided to alter the name of the Branch to the "Birmingham and West Midlands" Branch. This would enable foundrymen in Shropshire, Gloucestershire, Warwickshire, and Worcestershire who joined the Branch to feel that geographically the Branch was their own Branch. The Junior Section had not made the progress that he personally anticipated, but they had now secured the services of an active young Secretary, and the Council hoped that in the very near future the Junior Section would be put on its legs. It would be seen from the number of Council meetings which had been held that the Council had done a fair amount of work in the interest of the Branch.

MR. J. B. JOHNSON, in seconding, congratulated the members upon the work of the Branch during the past session.

Presenting the balance-sheet, the HON. SECRETARY said the income, including £11 10s. 6d. brought forward, was £241 13s. 10d. The expenditure, which included £15 in repayment of balance of loan to General Council, absorbed the whole of the income with the exception of 15s. 3d., which was carried forward.

The PRESIDENT proposed that the balance-sheet be approved, and MR. D. H. WOOD, in seconding, expressed the opinion that the financial result of the year was satisfactory in view of the large number of meetings held and the propaganda work which had been done.

The motion was approved, and, in reply to a question, the PRESIDENT said the membership register was now in a very healthy condition.

MR. D. H. WOOD, the Senior Vice-President, was elected to succeed Mr. Vickers in the presidential chair, and, acknowledging his appointment, invited the co-operation of the members of the Council and the general body of members in making the current year a most successful one. He appealed to every member to make a special effort to obtain at least one new member during the next few months.

Other officers were elected as follows:—Senior Vice-President, Mr. F. G. Starr; Junior Vice-President, Mr. E. H. Tyson; delegates to General Council, Messrs. T. Vickers, J. B. Johnson, and F. G. Starr; members of Branch Council, Messrs. F. C. Edwards, C. Dicken, F. Dubberley, and D. McQueen; Secretary, Mr. H. J. Roe; Treasurer, Mr. G. E. Dicks; Auditors, Messrs. J. H. Westwood and F. C. Edwards.

The retiring officers were cordially thanked for their services.

It was decided to hold the meetings of the Branch alternately on Thursday and Saturday, as during the past session, the Saturday meetings to start at 6 o'clock.

The PRESIDENT referred to the death of Mr. A. O. Backert, president and managing director of the Penton Publishing Company, with whom, he said, they had come into more intimate touch in recent years, by reason of the interest Mr. Backert had taken in the formation of the International Relations Committee, a Committee which was attempting to combine the common interests of English and American foundrymen.

The members rose as a tribute of respect to the memory of Mr. Backert.

The Production of Iron and Steel in April.

The production of pig-iron in April amounted to 569,800 tons, compared with 607,900 tons in March and 618,400 tons in April, 1924. The furnaces in blast at the end of the month numbered 158, a decrease of 11 since the beginning of the month and a decrease of 36 compared with the number in blast at the end of April, 1924. The production includes 187,400 tons of hematite, 188,500 tons of basic, 138,200 tons of foundry and 23,200 tons of forge pig-iron. The production of steel ingots and castings amounted to 597,600 tons, compared with 684,700 tons in March and 711,500 tons in April, 1924. Imports of iron and steel in April amounted to 274,400 tons, the highest figure attained since May, 1924.

The Selling of Castings.—XI.

BY VOYAGEUR.

There are twelve principal ways of advertising castings, and the simplest method of explaining these will be to give them their correct names, describe their scope, and show why and for what occasions they are useful. Briefly, then, the twelve are as follows:—

Humorous Campaigns.

(1) Humorous or whimsical campaigns are those in which the castings are treated in a familiar or comical manner. (Thus, instead of giving sound and serious arguments for the use of aluminium castings in motor-cars, the founder might dress up an aluminium casting to resemble some sort of effectively ferocious saviour and show it chasing away the little red devils of trouble from the engine.) These campaigns are sometimes successful and sometimes the reverse. It is never easy to say whether the buyer will look upon advertisements of this sort as very attractive and original or as unnecessarily impertinent and disrespectful. One has to risk something in this kind of series, and the founder whose general advertising has drawn good results will be very well advised to avoid humour or whimsicality in his announcements.

Educational.

(2) Educational campaigns are often of great use to founders when it is necessary to alter the buying habits or overcome the prejudices of the market. Thus, in the early days of electrical castings, an educational campaign was necessary to prove to buyers that castings possessing the requisite electrical properties for dynamo-magnets could be supplied in cast steel made by the Tropenas acid process. Previously cast iron had been used and steel had failed. But the invention of the new process changed the situation, and buyers had to be educated in the advantages steel possessed over iron.

This form of campaign is also valuable when it is necessary to put a new kind of casting on the market. Manganese-steel castings are a good example. This steel has excellent wear-resisting properties, but when it first came on the market engineers could not be convinced that its high cost was more than compensated by the longer life it gave to castings that underwent severe abrasive action. Educational advertisements had to explain exactly *why* manganese-steel castings could outstay those made from ordinary steel. In short, engineers were taught, just as school children are, what it was needful that they should know about the new material. It can also be employed to teach buyers new uses for the castings.

Historical.

(3) It is not necessary to dwell at great length on the "historical" campaign. The main object of this form is to stray a little from the beaten track, to interest the reader of an inquiring turn of mind, and to strike a different note from that sounded by competing manufacturers. Usually a series of historical advertisements describes the history of the castings from their invention or origin down to the present day, and generally concludes with a picture or photograph of the particular founder's castings as "the last word."

Institutional.

(4) Institutional advertising campaigns are much too common in the pages of the trade and technical Press. At their best they can be a very effective means of creating goodwill. At their worst—which usually means the insertion of a large illustration of the foundry, with the founder's name in big black letters all over the page, in a screen too fine for the quality of the paper on which the block is printed, and with a border resembling the edging of a funeral card—they create nothing except disgust at the blotchiness and bad taste displayed. Interest they certainly do not create.

Institutional campaigns concentrate chiefly on the foundry in which the castings are made, and on the men who produce the castings, not so much on the castings themselves. Their aim is to create prestige, confidence, a feeling of security. For this very reason their use should be confined to old-established firms of good repute and long standing, or else to firms of great size. They will achieve their aim only if dignified, free from brag and blatancy, in perfect taste, and pleasing to the eye. As the writer has indicated before, too much of the institutional advertising done by founders in this country is unsightly, vulgar, and ineffective. To advertise the works rather than the castings they produce is a costly because indirect form of advertising. The only founders who can, therefore, afford it are those who are well known and large in size. It is foolish for firms whose names, ages, and sizes are insignificant to adopt this form of campaign, unless they really have something unique to make a song about.

Testimonial.

(5) Testimonial campaigns are inferior only to argumentative campaigns in value and economy, though they are not entirely free from pitfalls. Their name accurately and adequately describes them. Their aim is to acquaint buyers of the fact that the castings in use have done certain remarkably fine things that can be properly authenticated, and that practically speak for themselves. If it is possible to give the name of the person under whose auspices the test was carried out, or in whose works the performance was effected, the advertisements are greatly strengthened. But certain pitfalls already hinted at must be studiously avoided. If the feat is one that sounds far too good to be true, human character is so constituted that there will be general disbelief in it, however well authenticated it may seem to be. A man who has been using mild-steel castings that last on an average a year will merely call you a liar if you tell him a manganese-steel casting will last twenty years when used in the same machine. Such a length of life is more than he can bring himself to believe in. It is as if someone were to come to you with a tale of a marvellous small cake of soap that would last for a year. The writer has often been compelled to hold up testimonials and details of record performances for the sole reason that they would sound ridiculously exaggerated to those who had not had experience of the product. As H. G. Wells has said, "Facts that the public won't believe aren't facts." The testimonial should show the performance of the castings to be good, but not astounding.

Again, users often try to get record results out of castings simply because "someone else has obtained them, *vide* the latest testimonial advertisement published by the founder." In doing this they often ignore the fact that the conditions of use may be totally dissimilar. Every detail should, therefore, be published in a testimonial advertisement, so that no excuse is left for the user who tries to do the impossible and blames the founder when he has failed.

Argumentative.

(6) The argumentative advertisement is far and away the best for the maker of castings. It gives a closely-reasoned account of why the particular castings are more worth buying than those the customer is at present using. (The competitor must not be mentioned. To do this merely invites comparisons. The buyer must be induced to think that since your castings are so good, the other man's cannot be their equal.) The great point about argumentative campaigns is that they are safe. One cannot go far wrong with them. They do, above all things, fulfil the principal requirement of casting advertising, which is to tell the buyer *something he does not know* about the castings. Argumentative advertising does not merely say the castings are better; it shows clearly and strongly why they are better. That is what the buyer wants to know.

Service.

(7) Service is a good thing to make the subject of a campaign, on one condition—that it exists. Service campaigns make a point of the service (whatever form it may take) the founder gives to his customers. But when once they are launched, steps must be taken to ensure that this service is really given. A customer who places orders on the strength of the service advertised will be twice as hard to conciliate if he finds it lacking as the customer who comes in the ordinary busi-

ness way. Service, competently and freely given, is one of the things a buyer is most anxious to secure and most ready to reward. Therefore to advertise it is beyond question the most effective form of *indirect* campaign, and it can be recommended if the founder feels sure that he can and does give the service that he offers.

Allegorical.

(8) The allegorical campaign is only needed when it becomes necessary to advertise the castings in an unusual and striking fashion. It is useful, for instance, for goods of a standardised kind that are little different from competing goods, e.g., fall pipes. The allegorical advertisement expresses the castings in terms of something extremely different, and by using metaphor, simile, analogy, etc., it establishes an arresting and unexpected connection between them that captures the imagination of the reader and ensures his attention. Thus, a strong casting might be represented as Hercules performing his labours or as a strong tree defying a hurricane. To secure good results the allegorical campaign must be carried out with great care, and the reader's imagination must not be strained too greatly in creating a link between the casting and the analogy.

Quality.

(9) Quality campaigns do not argue about the casting, but simply declare in a dignified way its essential good quality. Advertisements may point out that such-and-such a high-class firm uses the castings, and therefore their quality must be high; or they may outline the care used in choosing ingredients, in testing before despatch, in manufacture; or they may describe the exacting character of the work for which they are designed. But the quality campaign need only be used when the argumentative campaign runs short of material.

Pictorial.

(10) Pictorial campaigns consist of advertisements that are virtually miniature posters. This is an expensive form of campaign not wholly justified by results so far as castings are concerned. A picture and a "slogan" or catch-phrase make up the whole advertisement. But it takes more than a catch-phrase and a picture to sell castings to a skilled buyer.

Trade Mark.

(11) Unfortunately, trade-marks are not often put on castings, and therefore trade-mark campaigns are not of great consequence to the founder. If he has a famous trade-mark and casts it on his foundry products, it will pay him to sing a song in his advertisements of the significance in trustworthiness and quality of this mark. Otherwise he need not worry about this form of campaign.

Negative.

(12) Negative campaigns are a useful variation from the ordinary advertising. They show the castings in a new light by indicating what they will *not* do, not what they *will* do; by saying what will happen if you do *not* use them, not why you ought to use them. Thus you say, "Blank's steel castings will not crack," and not "Blank's steel castings are thoroughly sound and strong." Or you say ,"A new machine broke down a week after purchase because its baseplate did not come from the Blank's foundry," instead of "By using Blank's castings you prevent breakdown." But founders should, generally speaking, avoid negative campaigns. They need skilled treatment and are dangerous.

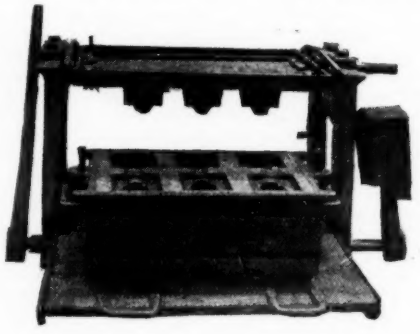
These are, as already pointed out, the twelve principal forms of campaign. There are others, such as the "trade character" (a typical user or producer who figures in every advertisement and talks about the castings); the "take your own medicine" (in which the founder indicates why and where he uses his own castings); and the "catalogue" (in which the manufacturer advertises not his castings but a book about his castings). But the founder himself must decide what form is most suited to his particular goods, and having decided, he should stick to his decision.

Concerning advertising, only two things now remain to be described—the checking of advertising results in a systematic way, and the main principles of advertisement design. But before these important matters are discussed, some indication must be given of the right way of instituting an advertising department, so that the founder may see for himself exactly what this involves. This matter will, therefore, form the subject of the next article.

A Novel Hand-Ram Turn-Over Moulding Machine.

For a simple and robust moulding machine the "Howie" model has much to recommend it.

The standard machine—the framework of which is 32 in. high, 36 in. wide, and 20 in. back to front—takes boxes up to 24 in. × 18 in. × 8 in. deep. The patterns can be fixed to a planed pattern plate, or the patterns and plate can be in one. For ramming purposes, the pattern plate is held perfectly rigid by a pin and socket arrangement. After ramming up and levelling off, the box is clamped by wing-nut clamps to the pattern plate, and they are turned over. By pulling the lever shown on the left-hand side of our illustration, a cam action raises the stripping plate, which carries a draw board (running on castors) provided with



The Howie Moulding Machine.

two inverted V-shaped bars to meet the box. After unclamping the box from the pattern plate, the stripping is accomplished by gravity, controlled by the hand lever, and the action is facilitated by the counterbalance weight shown on the right. The stripping of the patterns is particularly sweet, as the cam engages the stripping plate on polished surfaces, and the guide rods are immersed in oil when not in use. All working parts are completely protected from sand. The machine is thoroughly workmanlike and well made, and should find a large sphere of usefulness in foundries where repetition work is done and light or medium weight castings are made. The machine is in regular use at the works of the patentees, Messrs. John Booth & Sons, Ripponden, near Halifax, where, we understand, it can be inspected by *bona-fide* foundrymen.

A.F.A. Appoint European Representative.

Mr. Vincent Delport, manager of the Penton Publishing Company, Limited, 2, Caxton House, Westminster, has been appointed the European representative on the American Foundrymen's Association Committee on International Relations, with the object of acting as liaison officer for intending visitors to the International Foundry Congress to be held in Detroit in the autumn of next year.

Mr. Fletcher to Visit America.

Mr. J. E. Fletcher, the consultant to the British Cast Iron Research Association, proposes personally to present his Paper dealing with the interrelationship of metallurgical processes, which he is preparing for the Syracuse Conference of the American Foundrymen's Association on behalf of the Institute of British Foundrymen.

The Selection of Iron by Fracture and Chemical Analysis.

An illuminating discussion was recently held by the West Yorkshire Metallurgical Society at Huddersfield, over which Mr. H. F. Coggon presided.

Analysis Paramount.

MR. T. L. POOLE (Low Moor), who opened the discussion, said he thought that it was impossible to select iron either by chemical analysis or by fracture alone. He exhibited two samples of pig-iron, which showed exactly similar fractures, but one of which contained 1.3 per cent. silicon and the other 0.5 per cent. silicon. These samples showed that a wide variation of analysis was liable to be found in apparently similar irons, and that chemical analysis was primarily important. When selecting iron some of the more important constituents of the analysis must be considered, and it may be entirely misleading trying to select by fracture alone under modern methods of manufacture. For the foundry manager successfully to carry on his business he must have both chemical analysis and fracture. The speaker advocated buying and selling all iron to analysis, and he would certainly, before taking any iron from anybody else, require the analysis.

Similar Analysis but Different Properties.

MR. G. LEDGARD (Halifax) did not agree with Mr. Poole that fracture was of so little importance. It was possible but not the general rule to find a No. 4 fracture with a No. 1 analysis. One was quite justified in expecting consistent fractures when conditions of manufacture were the same. When buying ordinary pig-iron one found considerable difficulty in getting makers to come within reasonable limits of a given analysis. It was often impossible to get pig-iron makers to guarantee a specified analysis. It was possible to get two irons with the same analysis but with entirely different physical properties. If the fracture was of so little value how would it be possible to tell which was the better of these two irons? Cold-blast iron was admitted to be superior to any other kind of iron, but it was possible to buy iron much cheaper with the same analysis as cold-blast iron. When made into castings, however, there was no comparison between the two irons. If they were to judge by chemical analysis alone how would they explain the difference in the physical properties of these two irons? Why should a cold-blast iron be better than one made by any other method of manufacture?

Cold Blast Unreplaceable.

MR. POOLE said that that was what they all wanted to know. Even the late Mr. Buchanan had been unable to answer that question.

MR. H. R. PITT (Wakefield) agreed that cold-blast iron had virtues which no other iron possessed, and for certain classes of work more than held its own.

MR. POOLE, in reply to a further question by Mr. Ledgard, said that it was not the general rule but there was a great tendency in America to use pig casting-machines.

Effect of Abnormal Impurities.

Continuing, MR. LEDGARD said that one found that pig-iron, cast in pig casting-machines, that was chilled, would have a different fracture from pig-iron cast in sand moulds in the open air. Some eighteen months ago a Paper was given before the Institute of British Foundrymen dealing with the effects of small amounts of impurities such as chromium on pig-iron. Was the presence of such unusual impurities responsible for the unusual fractures exhibited by Mr. Poole? Had there been a really full analysis made of these samples?

Fracture Unreliable.

MR. R. BLAKELEY (Wakefield) said that in ancient times the ironfounder knew that it was desirable that his castings should on fracture show a certain grain, and he selected his pig, where any selection was possible, to give him the required result. As the variety of castings required and a knowledge of the properties and constitution of castings and pig-iron increased this practice developed into a fine art, in which the aid of the chemist played no small part. The fracture, while giving some indication of the physical properties of the metal was not a true and unfailing guide to the chemical composition. On the other hand the analysis furnished by the chemist may not give any correct idea of the physical properties of the metal, so that it was obvious that both fracture and chemical analysis should be taken into account. When selecting pig for casting, the metal must be suitable for the castings required, and it must be as cheap as possible consistent with the quality desired. Before relying on the selection by fracture alone it must be borne in mind that the fracture could be practically changed at will. The retardation of the period of cooling by having heavy sectioned pigs and covering the metal with sand as fast as the moulds were filled made very open and coarse-grained iron, and what would normally be a No. 3 was changed into a No. 1 fracture. When an iron was remelted it was usual to find in the resultant casting a similarity of structure to that of the original pig, but on numerous occasions quite the reverse result had been observed.

Silicon can Act Inversely from Normal.

A low-silicon content did not necessarily harden the iron, nor did a high-silicon always soften it, as the following examples showed. Castings made with the analysis G.C, 2.79; C.C, 0.56; Si, 2.26; Mn, 1.68; S, 0.052; and P, 1.03 per cent. should be soft and easily machinable. Actually when cast in a green-sand mould, stripped as soon as set, and cooled in the air, the castings were unmachinable, and, even when left to cool in the mould, were machined only with difficulty. On the other hand, a plate cast from No. 3 open-grained iron with the analysis T.C, 3.35; Si, 1.0; Mn, 1.64; S, 0.032; and P, 1.0 per cent. could be machined easily. A sample of iron of the following analysis—G.C, 2.25; C.C, 0.86; Si, 0.94; Mn, 0.65; S, 0.048; and P, 0.31 per cent.—in spite of the low-silicon content, had a very open fracture and was very soft and rather weak. This iron was melted in the cupola. Some was poured into an open sand mould for a plate 3 ft. × 4 ft. × ½ in. The remainder was poured into castings which had to withstand hydraulic pressure of 400 lbs. per sq. in. If the iron had acted according to its analysis, the open sand casting would undoubtedly have split whilst contracting. The plate, however, was perfectly sound, machined easily, and when broken up for examination showed an open-grained fracture. The other castings also machined easily, but when put under pressure, leaked, and were porous from one end to the other. It often happened that an iron with chemical analysis and fracture in accordance with a close grain, when remelted, had a more open grain than it had in the pig and under hydraulic test showed its porosity. Through a casual glance at the fracture of such iron one might conclude it was an ordinary close No. 4, and use it as such, but after a more careful scrutiny one would note that the graphite flakes were small and gave the fracture an appearance similar to a lump of sugar. This state of the graphite was possibly due to rapid cooling of the pig when manufactured, and the normal rate of cooling would have produced a large graphite flake.

Unexpected Good Physical Properties.

The following class of iron gave remarkable physical properties, although the analysis did not warrant such results:—T.C, 3.25; G.C, 2.64; C.C, 0.61; Si, 1.34; Mn, 0.86; S, 0.127; and P, 1.0 per cent. The iron showed on the surface a fine white network, the interstices of which were dark grey. Such a structure was generally found in an iron high in sulphur. On examination microscopically the grey background seemed to be composed chiefly of finely-divided graphite. Judging from a sulphur print, the white network seemed to be high in sulphur. These conditions increased the strength considerably. A test bar 2 in × 1 in. × 36 in. centres cast from this mixture broke under a load of 50 cwts. with a deflection at 40 cwts. of 0.4 in. Another bar with practically the same analysis—G.C, 2.52; C.C, 0.73; Si, 1.23; Mn, 0.93; S, 0.122; and P, 1.02 per cent.—but without the network structure, gave only 35-cwts. breaking load with .39-in. deflection. A common-sense application of both fracture and chemical analysis was therefore necessary if definite and reliable results were to be obtained.

XUM

Mr. Blakeley also exhibited two samples of iron, one containing 0.90 per cent. silicon and the other 5.0 per cent. silicon, both with 0.02 per cent. sulphur, which had exactly similar fractures and were both open and easily machinable.

Martensite can Mask Fracture.

Mr. Pitt said that it must be recognised that the controlling factor in pig-iron as regarded mechanical properties was the graphite. Other constituents determined the balance of combined carbon to graphite. It was often thought that the amount of combined carbon in a pig-iron determined its quality, but that was quite erroneous. The strength and physical properties did not follow the amount of combined carbon, but they did to a great extent follow the ratio of combined carbon to the graphite. Sulphur played an important part in the structure of irons. Most low-sulphur irons had a very open structure. Iron with 0.025 or 0.03 per cent. of sulphur and 1.0 per cent. silicon would show a very peculiar fracture. Its properties were inherited from the blast furnace, and no amount of remelting would bring back the closeness of structure usual to low-silicon iron. There could be no doubt that sulphur increased the amount of combined carbon in an iron, and if that could be so distributed as to form a network structure it would yield iron of exceptional strength. This property was not always extended when the iron was remelted. Thus an open grain may persist in cupola metal and in other cases it would not. It depended on the sulphur, which in turn depended largely on the kind of coke used and the rate of melting. As to the question of judging iron entirely by fracture, he thought that if one knew the history of the iron one may then go straight ahead. The risk of taking unknown irons, however, and judging them on fracture was quite considerable. There were certain things one could do to find out what kind of iron was being handled besides doing an analysis. The composition of all alloys had taken on an entirely different aspect since microscopic examination was introduced. With freak irons the microscope revealed the trouble. For example, the presence of large amounts of martensite would give very hard, unmachinable castings.

Mr. H. F. Coggon (Halifax) thought that the fracture test was just as useful to-day as it was thirty years ago, and it was as important as the chemical analysis. The one was the practical man's way and the other was the technical man's way of judging iron.

Mr. H. C. Dews (Huddersfield) said that of all industrial metals and alloys cast iron was one of the oldest and the most used. It was intrinsically a weak alloy, and would not withstand exacting working conditions. It was seldom made, therefore, to rigorous specifications. In consequence of these factors there were a very large number of people who had been associated with cast iron manufacture, and very few of them had required or possessed a fundamental knowledge of the constitution of cast iron. Rule-of-thumb methods had held sway, and a prolific growth of superficial theories and empirical suppositions hedged in iron-foundry technique. To add to the confusion, they had had more than one experience of foundrymen who, through a not inhuman desire to create a little diversion in their daily work, deliberately misled their colleagues with half-truths. It was very welcome, then, that the present discussion had been characterised by a real desire on the part of all the speakers to expose the fundamental considerations affecting this subject.

Giant Transformers.—In the last year or two, many orders for super-electrification schemes in various parts of the Empire have been placed in this country, and early last year Messrs. Ferranti, Limited, secured an order for four 30,000-k.v.a. (B.E.S.A. rating 46,500 k.v.a.) 118,800-volt three-phase transformer groups for the Tata Power Company, Limited, of India. The transformer groups in question are the largest yet made in this country, and form part of a hydro-electric scheme for transmitting electricity at extra high pressure to Bombay by an overhead transmission line 70 miles long.

A Note on Apprenticeship.

There are very few mechanics who can claim to be engineers, because they have not obtained a sufficient experience while serving their apprenticeship. An engineering employer expressed the opinion to the writer, recently, that it would be all to the good of the industry if every apprentice obtained some experience in the various shops. Before engineering became specialised this was the practice, but now apprentices are of two kinds, *i.e.*, engineering apprentices and craft apprentices. The former spend, it may be, five years between pattern shop, fitting and machine shops, and ultimately go to the drawing office; the latter serve five years in one shop, and remain there. In quite a number of shops now examinations are held for entrance to the drawing office, and all apprentices are given an opportunity of competing.

In some sections of engineering, apprenticeship is disappearing altogether. Skill is not necessary for one-operation men in a repetition factory. What is forgotten, however, is that mobility has some value, and a well-known American engineer, on a visit to this country about a year ago, told the writer that America was gravely handicapped by the scarcity of really skilled men, and regards this country as an invaluable reservoir to draw upon. It is well that the men at bench and machine should be able to take supervisory positions if called upon. In many highly-specialised shops it is impossible to have any apprenticeship system, but it is altogether different in marine and locomotive shops and with general engineers.

Engineering does not benefit by specialised apprenticeship. There are very few men in a fitting shop to-day who can work a lathe, and just a few machine men who can use a file. A boy enters a workshop at sixteen and remains in it until he reaches the age of twenty-one. The result of this is that engineering labour is not as mobile as it might be. Why should not a boy serve two or three years in one shop and then pass into another shop. It used to be fairly common after completion of apprenticeship for a boy to go into another shop for which he had a preference and serve one or two years as an improver, but this system has almost died out.

It is generally recognised that the most valuable draughtsman is the man who has worked in the shop. In America it is not uncommon to promote clever shopmen, who have a technical knowledge, to positions in the drawing office. We know of large engineering firms in this country that have apprentice draughtsmen who do not get any practical workshop experience. This is regrettable, because the man with the machine shop experience realises that there are limitations to what machines can do, and he learns the need for tool clearances and such like. He also obtains an understanding of the capabilities of various types of machines which, in some degree, influence design. In the erecting shop, and also in the testing shop, he obtains much knowledge of an extremely valuable kind.

It does not seem to the writer that there should be any difficulty in reverting to the practice of forty years or more since and dividing apprenticeship between two shops. A boy who has spent two years at a lathe very quickly adapts himself to bench work, and is soon even more valuable than the boy who has been on bench work all the time. In this way we should get real craftsmen with a skill comparable to the old school of millwrights, of whom few are left. The writer knows men of this type who could design a train of gears, and, after they were cast, erect them in position, and there are very few young men to-day who could do so.

J. M.

The annual meeting of the Royal School of Mines (Old Students) Association will take place at the Metallurgical Club, on Tuesday, May 26. Mr. J. Kelly has been elected president for the coming year, and Professor W. H. Merrett and Mr. B. Howe, vice-presidents. The 48th annual dinner of the Royal School of Mines will take place at Gatti's Restaurant on the same day, with Mr. R. Pawle in the chair.

Pearlitic and Lanz Iron.—Part II.

By M. N. S.

The first portion of this article, published in the Journal early in February, gave rise to comments which were unexpected by its author. Some people described it as "one for Lanz"; others said it was "a splendid advertisement for pearlitic iron"; one, at least, remarked that "he had never read such tripe in his life." All this being remarkable in face of the fact that the article was not intended to be an attack, an advertisement, or even "tripe."

The fault was that it was impartial; and, as is invariably the case, the supporters or opponents of one side or the other always read an impartial document as being either strongly predisposed to their own opinions or else venomously prejudiced against them. Such is the fate of he who attempts to be impartial. Notwithstanding that the contribution has been misconstrued, its author remains of the opinion that the article in question was the fair and just exposition of one who "wanted to know" and who desired certain straight questions answered in a straight manner.

The article was a note of interrogation. It dispensed with the term "pearlitic"—about which one can argue oneself pink and get no further—and went on to ask a series of questions, and to state a number of cases, all of which were intended to be pertinent, not impertinent.

The idea of the writer was that the humbug, the quack and the imposter detest, above all other things, pertinency. It is the one weapon to which their armour is not proof and which upsets their equanimity. Any quantity of foolish queries they welcome, but a truly pertinent inquiry is called, by people of that calibre, unfair. Frequently, their reply is to talk more loudly than usual, apparently on the assumption that the greater their noise the better their argument; at other times, they will be rude, and, in fact, will try every trick of their repertoire rather than face the issue.

Hence, the opening of this article was, as has been stated, a note of interrogation. It was offered as an "acid test," and as such has it been taken by those concerned.

We, who know, know that German metallurgy has been sound fundamentally for as long as we can remember. Whether their foundry work is as "semi-steely" as that of the English-speaking nations the writer is not in a position to judge, but that their knowledge of metals is reliable has never been in doubt in our time. The German seldom overstates his case, and his case seldom needs overstating. His goods are, as a rule, so marketable, so well served-up and so priced, that accurate and full descriptions are more suitable than the boosted exaggerations so frequently, and so mistakenly, described as "smart" advertisements. This is, by no means, an attempt to place a halo around their heads, but a plain statement of fact which everyone can prove for himself if he likes to compare the majority of their advertisements with those of certain countries whose names it would be invidious to mention. Solid facts will sell an article or a process, in this present-day scientific foundry world, better than will platitudes, bare statements or gross exaggerations. The day of the foundry article which obtains a sale by reason of inflated or unfounded advertisements is coming rapidly to a close, and the British foundryman is beginning to realise that all is not good pig-iron that glitters, and many other such points.

Hence, it may be seen now what was in the writer's mind when he penned his article in that particular style. The trouble about this Lanz process is that it is in advance of the times. Too many of us do not understand such things; some even do not know the composition of the iron they use daily; some know sufficient to enable them to make a show of knowledge and no more; many have had no chance, no opportunity and no encouragement to learn. We have, as a nation, starved our foundries of knowledge, apparatus and materials. Castings have been forced down to prices which gave no chance for good wages to be paid or good metal or methods to be used. Engineering has forged ahead with the best brains and apparatus which money could buy, whilst, at the same time, the engineer, as a class, has ill-treated the trade which delivered to him the goods upon which engineering most depends, namely, iron castings. Granted that the castings were cheap and served their immediate purpose, but was that all which needed to be thought of? Was that the alpha and omega of those at the top? Is this all we have to consider in this world? The writer thinks that these questions need no answer, and that those men and those firms who have spurned science and knowledge in order to save what would have been an infinitesimal expense to themselves and their shareholders, will meet inevitably their retribution and will have the meagre satisfaction that they have made a little more money at the expense of their country and countrymen.

Entirely owing to the above reasons is the state of our foundries to-day, and were it not for a few far-seeing and patriotic managing directors, chances of ever being able to produce the castings required for the engines now being designed and developed would be slender indeed. As in the opposite case, so such men and such firms will reap their just reward.

Basic Differences.

The Lanz process places in our hands the very thing which we need, and must have, if cast iron is to hold that place in future engineering which it has in that of the past. By its means we can make grey castings from iron which, by our ordinary methods, would make white ones. From this we come directly to the fact that, therefore, the Lanz casting is pearlitic, or practically pearlitic, throughout all its sections. Obviously, any such process must have its limitations; but they are wide ones, far wider than those of ordinary foundry practice, and do not interfere with the success of operations applied to commercial work except it be of a most unusual character.

The author's first article said that the Lanz iron contained less silicon than ordinary iron of similar casting section. Therefore it follows that it enables the iron to possess properties which ordinary iron cannot have. For instance, an intricate and thin cylinder would need, in the usual run of things, to be made of iron containing nearly 2 per cent. of silicon and a fairly high percentage of phosphorus; whereas, under the new system, that cylinder will be cast of iron containing, possibly, well under 1 per cent. of silicon and a very small amount of phosphorus.

This is not the place to go deeply into metallurgical considerations, but it is essential to point out that it has been proved that low-silicon iron has properties vastly superior to those of higher-silicon metal.

Graphite and Grain Size.

The previous article—if such constant reference to it can be tolerated—asked whether there was not a difference in size of graphite and of pearlitic lamellæ, including, of course, grain size. As a matter of fact, this is one of the most valuable and remarkable features of the new process. It will appeal to the foundryman to know that not only are such castings pearlitic throughout all sections but that all sections have the same grain or fracture. The author wishes to digress for a moment in order to say he has noticed that the term "Perlit" has been applied to castings made under this system and, as he thinks it is a suitable means of getting away from the description "pearlitic," the iron having properties which are not included under any one such metallurgical term, he will henceforth refer to the metal as "Perlit" iron, and, to the process as the "Perlit" process.

Close Grain Assured.

Everyone familiar with cast iron knows that its greatest and ever-present defect is one of grain-size. Even a test bar is different in its centre from what it is nearer its outside; in castings the trouble is far worse, and the grain varies from section to

section, and where two or more sections meet the trouble becomes merged into those things which foundrymen describe as "open" metal, fosiness or draw-holes according to the degree to which the evil is apparent in any one particular case. Under the conditions of the "Perlit" process the iron has the same grain throughout, and even where it has intimate contact with the mould's surfaces there are almost no chilling effects observable. Of course, it follows logically that such iron has similar closeness, hardness and non-porosity throughout its sections and throughout all sections. Such statements may appear improbable to those who have seen nothing save cast iron made under ordinary foundry conditions, but the "Perlit" iron demonstrates itself, and those who ask pertinent questions can be convinced by seeing for themselves.

"Perlit" and Pearlitic Cast Iron.

The author asked whether the pearlite of "Perlit" iron was different from that of cast iron. This question hardly meets the case as stated by its inventors. Obviously, any interference with the conditions at the time the iron passes through its critical ranges will affect the distribution, condition and size of those things which are the cause of the critical ranges existing at all, namely, the pearlite, the graphite and the grain. This is common metallurgical knowledge and is the basis of metallurgy. Hence it follows that "Perlit" iron has essential and subtle differences from ordinary pearlitic iron; in any one section the pearlite and graphite are finer, and properties are bestowed which render the iron more resistant to shock and impact, less porous and stronger. All this brings the realisation that, at last, we shall be able to obtain benefits from the addition of rare metals to cast iron, because it follows that, as in the case of steel, the addition of other elements is valueless unless heat-treatment follows.

Motor Cylinders.

The suggestion was made by the writer that the "Perlit" process needed controlled compositions if it were to be fully effective. Any foundry practice of any kind must include composition control; the old-fashioned "mixtures" are known already to be absurdities, in which only the ignorant have faith and which produce castings rarely twice alike. At the same time, the "Perlit" method introduces certain advantages not immediately apparent. For instance, take the case of the manufacture of motor cylinders. There one could use low-silicon and fairly high-sulphur pig-irons and, by mixing them with steel, could ensure that the grain of the castings was the same from cast to cast the year round. The castings themselves would be freer from defects, hard spots, sulphur and phosphorus troubles; feeding heads and so on would be reduced considerably, and the metal would be strong in tensile, transverse and resistance to impact and also non-growing. The amount of supervision required for a foundry making repetition castings of this kind would be inconsiderable, and no more than required at present when the job is done efficiently.

Previously, the writer dealt at some length with the powerlessness of the ordinary foundry to control its metal, but that has nothing to do with the "Perlit" process, and it would be absurd to expect success with a modern process if methods of a hundred years ago were in vogue in the foundry using it. There remains no doubt whatsoever but that this process worked in a modern foundry would prove a revelation.

Temperature Gradients.

The author wrote as follows: "The desire to know these things does not suggest that he does not credit them; rather does it prove his serious interest in the matter. The subject of temperature gradients within sand moulds, preheated or otherwise," etc. That is the point; *temperature gradients*. For this one reason the "Perlit" process is an invention of the highest order. It alters the temperature-gradient and the heat-content of the sand into which the metal is about to be poured. Any foundryman, any metallurgist will see that an alteration of this nature cannot fail to have most vital effects upon the final metal.

This process frees the hand of the metallurgist to as great degree as it solves the problems of the foundryman. No longer need to use high-silicon, high-carbon, high-phosphorus metal, no longer dangerous to enter those realms where dwell the non-growing irons, the friction-resisting, the shock-resisting alloys.

The writer mentioned beforehand the need for accurate research work on cast iron and for the right man to conduct it. The "Perlit" process will act as the greatest spur to research that has yet occurred in iron foundry history. Like most strong and successful inventions its greatest asset is its simplicity and adaptability. It is one of those things which makes one kick oneself for not having thought of it. The idea, of a precise composition combined with a precise mould temperature for certain average thicknesses of castings opening the hitherto closed door behind which are found the low-silicon, low-phosphorus irons, is one which is entirely original yet which is obvious, when the clue is provided.

In conclusion, let it be said that there is no necessity for anyone to say that they do not believe; it is not a question of belief or faith, but one of sheer facts which anyone may examine for himself, and which are indisputable either on metallurgical considerations or on the result of sheer practical examination of the "Perlit" castings themselves. A particular note should be made here of the fact that such castings speak for themselves; and some of them are such as could not possibly be produced by the ordinary methods, and, moreover, the foundryman merely has to look at them and at their fractures to realise it. The metallurgist, on his side of the question, knows what compositions can be used to make grey castings of certain thicknesses, and, therefore, will realise that the "Perlit" compositions are superior, and such as could not be used in cold moulds. The only point remaining is whether this country is capable of taking full advantage of a discovery which is going to revolutionise foundry work and put new life into the cast iron trade. The answer to this is that, in the writer's opinion, despite our bad trade and the sad position of many foundries to-day, we are as fit as ever to make good and to make progress. We need to start, that's all.

A New Non-Corrosive Metal.

According to the "Iron Age," a new metal to be known as imita-gold, which will resist corrosion from acids, alkalies and sea water, according to the manufacturer, has been placed on the market. The metal is said to possess the hue and lustre of gold and the tensile strength of high-carbon steel. Title to the manufacturing rights of the metal in the United States, Canada and Mexico are held by the Imita-Gold Corporation, West Haven, Conn. The Corporation recently was formed with authorised capitalisation of $50,000. It has a fully equipped foundry and will also manufacture imita-gold bearing bronze and a nickel silver called imita-silver.

An interesting claim for the process is that it produces a metal whereby copper and aluminium can be combined into a homogeneous alloy without pores or blow holes. Imita-gold induces a natural lubricant into the metal, according to the patentee, and a bearing may be run dry at intervals without undue heating.

The Corporation expects to market this metal in the form of sheets, tubes, rods and wire. Hugo Youngstrand is president.

A MEETING of Sheffield Steel Products, Limited, was held last Thursday to consider the statement of affairs at the date of the termination of the receivership on May 21, 1924. At that date the issued share capital was £450,036, first mortgage debenture stock £989,914, second mortgage debenture stock £255,556, and creditors £122,255. Assets include land and buildings, plant, fixtures, etc. (less reserve of £1,057,669 provided under the scheme of arrangement), £1,644,852; investments (at written-down value), £13,702; stock-in-trade, £121,781; debtors, less reserves, £90,563; and reconstruction account, being adjustments in respect of debenture interest capitalised and other provisions, expenses of reconstruction and trading loss during receivership, £147,933.

Institute of British Foundrymen.

London Branch.

WORKS VISITS AND GENERAL MEETING.

On Saturday, May 2, some sixty members of the London Branch of the Institute of British Foundrymen visited the works of the Skefko Ball Bearing Company, Limited, and the foundry of the Davis Gas Stove Company, Limited, at Luton, Bedfordshire.

Visit to the Skefko Works.

The members were welcomed at the Skefko Ball Bearing Company's works in the morning by Mr. S. J. Aires, the secretary of the Company, and were conducted in separate parties through the works, where three hours were spent on the inspection of the processes of manufacture of ball and roller bearings, as well as the testing of the bearings. The laboratories were also inspected.

Following the inspection of the works, the members were entertained to luncheon by the Company, when Mr. Aires presided.

THE MANUFACTURE AND APPLICATIONS OF BALL BEARINGS.

After luncheon, MR. R. ALLEN, the chief draughtsman to the Company, delivered an interesting lecture on the above subject, in which he dealt with a few of the characteristics of the different types of bearings which the Company manufactured. Before he joined the Company, he said, he had very vague ideas as to what ball bearings really were. He had been rather chary about using them, and when he had had to use them he picked out from catalogues and chose a bearing, basing his selection on the loads given in the catalogue. To-day, however, he had a better appreciation of the subject, and he hoped his remarks would help his hearers in a similar way.

The first bearing to which he drew attention was the single-row filling slot type. That was the bearing which was first developed, and it was really the forerunner of the modern bearing. It was developed by a German firm, who had really put the subject of ball bearings on a precise mathematical basis. That firm had made the filling slot by cutting little slots in the side of the ring, so as to get as many balls into the bearing as possible, the idea being that with a greater number of balls there was a greater load-carrying capacity. The experiments carried out by the Skefko Company, and the research carried out in other works, had shown that the weakening of the rings in that way rather spoiled the calculated load-carrying capacity, and the Skefko Company had found that in actual practice it was much better to use a bearing which had rings with the section uniform right round the rings. The slot in any part of the ring would mean local weakness, and it set up local stresses. Eventually the Skefko Company had developed another type, the single-row non-filling-slot type, which was practically the same in appearance as the filling-slot type, except that the filling slot had been omitted. In the development of it the Company had sent a number of bearings to the National Physical Laboratory for test, in order to prove just what these bearings could do, both with regard to the carrying of radial loads and thrust loads. One of the staff of the National Physical Laboratory had selected a number of bearings from standard stock. The catalogue rating for that particular bearing was 800 lbs. at 1,000 revs. per minute. The bearings were tested with varying combinations of radial and thrust load, from 100 lbs. thrust load and 1,200 lbs. radial load, to 100 lbs. radial and 1,200 lbs. thrust load, and every one had come through the tests without showing any signs of fatigue, but similar bearings with filling-slots developed failure markings at the filling-slot position.

Measuring the Capacity of Ball Bearings.

Efforts were then made to obtain increased capacity, and the double-row rigid type of bearing was developed, having two rows of balls between two rings. It was of quite rigid construction, and presented certain difficulties in manufacture, so that actually in the finished bearing one did not obtain twice the capacity of the single-row type, even though there were twice the number of balls in the bearing, because it was impossible to make the tracks line up properly. Another point about the bearing was that if the shaft should endeavour to get out of alignment and the bearing were working up to its full capacity, there was quite a possibility of overloading to the extent of 50 per cent. on one of the rows. To overcome that difficulty the double-row rigid type with self-aligning casing was developed, in which the same bearing as the one previously referred to had been used, but the outside of the outer race was of spherical form, which fitted into a housing having the same internal shape. But in that case also it was found that a row of balls would easily be overloaded, because it was difficult to lubricate the surfaces; with non-lubricated surfaces the co-efficient of friction would be very high, and the turning moment required to make the bearing function on a bent shaft was very high, and imposed additional load on one row of balls. Then the S.K.F. Company had evolved a double-row self-aligning bearing, which allowed for self-aligning in the bearing itself, and during the rotation of the bearing it was exceedingly easy to make the bearing swivel. This bearing had all the advantages of the previous type, without its disadvantages, and for an ordinary line shaft, where one might get sagging columns and all kinds of little things happening, that type of bearing was really the bearing *par excellence*. If there were three bearings on a shaft, the shaft was constrained to some extent, and the centre bearing and side bearings would have a certain amount of extra load on them during the bending of the shaft. This particular bearing was not intended to overcome that difficulty, but it would stand up to those conditions provided the load capacity was high enough to deal with those conditions.

Roller Bearings.

Coming to roller bearings, Mr. Allen referred to a make of spiral rollers not manufactured by the Skefko Company, who did not agree that it was a true roller bearing. The rollers were made from a strip of steel wound spirally. The whole tendency of roller bearing design had been to get down to a short roller which was no greater in length than in diameter, and that was the basis of which cylindrical roller bearings were made to-day. The usual type had a parallel outer race. That had certain drawbacks, on account of the difficulty of making the race perfectly parallel and at the same time keeping it parallel with the rollers in the race. Should the roller or the race be slightly tapered there would be serious loading at one corner of the roller, with consequent chipping and early failure. For that reason that type of bearing must be very carefully mounted in the machine, to prevent any mis-alignment effect. To overcome that difficulty, the Skefko Company had developed the cylindrical roller bearing with curved outer track. That prevented the load from coming on to the corners of the ring, and it was quite clear that the capacity was as great, and perhaps a little greater, with the curved race construction than with the parallel race construction.

Tapered Bearings.

In order that a roller bearing should be able to deal with both thrust and radial duty, the well-known type of tapered roller bearing was developed. This type had been very popular, and the S.K.F. had developed a bearing of a similar kind, but with certain features in the internal construction which eliminated all the troubles inherent to a bearing of this type. They only recommended that bearing, however, for such duties as the front wheels of a motor car, and for that class of work it was perfectly suitable. For ordinary machine

construction they preferred to use the standard types of ball or roller bearings.

Double Row Bearings.

The final S.K.F. development was the double-row self-aligning roller bearing, which had characteristics similar to those of the ball bearing of the self-aligning type. This had all the advantages of the roller bearing, however, giving a very high capacity in a relatively small space. Dimension for dimension, it had about 100 per cent. greater capacity than the ball type of bearing. In addition to the quality of self-alignment, the internal construction was such that the troubles inherent with this type were not present. It was the only practical roller bearing which fulfilled all the necessities of very heavy duty work, and had been applied to railway trains, rolling mills and various other types of machines, where previously the plain bearing was used because nothing else could be used.

Co-efficient of Friction.

Dealing with the question of the co-efficient of friction for the different types of bearing, Mr. Allen said the be-all and end-all to some engineers, with the ball or roller bearing, was to cut down the power bill to the minimum; and, unfortunately, some manufacturers had overstepped the mark to some extent, and had led engineers to believe that they were going practically to cut out power bills altogether by using these bearings. That was not the case, however, and it was always a case of balancing the amount of power absorbed by friction with the amount of power doing actual work; it was only in regard to the power lost by friction that savings could be effected by the use of ball bearings. Usually, by the use of ball bearings or roller bearings, they could claim a reduction in friction of from 75 to 90 per cent., and that was no exaggeration, and, taking it on the basis of the total amount of power going through the machine, the amount of the saving was somewhere between 15 and 20 per cent., as a general rule. In some cases there were balanced drives, and there the friction effects are much lower, and the proportion of saving was consequently lower. Curves representing the co-efficient of friction related to the load were then exhibited, in respect of plain, ball and roller bearings. Speed, said Mr. Allen, did not really affect the co-efficient of friction beyond a practically negligible degree; the same co-efficient of friction applied when starting as when the bearings were rotating at the normal speed.

Industrial Application.

Applications of bearings were then considered, and Mr. Allen illustrated a number of applications by means of drawings. In connection with one illustration, showing the mounting of bearings on a short shaft, he emphasised that ball bearings were made to certain standardised limits, and, in order to obtain a proper fit, the recommendations of the ball bearing suppliers should be adhered to very rigidly, because if there were a slack-fitting bearing the tendency would be for it to rotate on the shaft and very quickly give trouble. If, on the other hand, it were a tight fit, it would expand the inner ring more than was intended, and they would take up a little diametric slackness in the bearing and consequently overload it. Amongst the illustrations there was included a drawing of a large thrust block as used on various submarines. A number of these had been supplied by the S.K.F., and they had worked very efficiently indeed.

Foundry Applications.

Other applications, which were of special interest to foundrymen, were to ladles, core-oven trucks, moulding machines, and the S.K.F. had supplied bearings for all these. In connection with core-oven work the chief difficulty was temperature, but he did not think the temperature was sufficiently high to worry them very much, provided a suitable lubricant was used. As to moulding machines, he was afraid that, on account of the low prices at which these had to be supplied the use of ball bearings would usually be found a difficulty, but if they approached it in a proper way the cost would not be very much increased beyond that of the ordinary plain bearing machine. In connection with ladles, he considered the advantages to be derived from their use were so great that the use of ball bearings was assured. It was not so much a question of cost, but of ease of moving the ladles, and it would be appreciated how important it was to be able to swing heavy ladles easily and to have control of them when pouring metal.

The selection of bearings was looked upon by most engineers as merely a question of picking up a catalogue and of picking out a bearing which, according to the catalogue figures, had a capacity suitable for the job in hand. It was most important to remember, however, that a ball or roller bearing had a certain fatigue limit. He believed the S.K.F. research department was the only ball bearing organisation which had really developed the subject fully on the technical side. They had actually discovered how long a bearing of a particular type would run, in number of hours, at any given speed and under any given conditions of loading. If the load were doubled the life was reduced, and *vice versa*, the variation being roughly inversely as the cube of the load; *i.e.*, if the load were doubled the life would be reduced by about eight times, and if the load were halved the life would be increased by about eight times. In the case of an electric motor running at 720 r.p.m., there would probably be several million stresses at one point in the raceways during a 24-hour day. In the case of a bearing for a turntable, where the number of revolutions was small, the number of stresses at a particular point in the raceway might be only 20 or 30 in a day. These various conditions must be taken into account when bearings were selected.

Finally, Mr. Allen said that, if any of his hearers were particularly interested in any particular applications of ball or roller bearings they should not hesitate to submit their problems to the bearing suppliers, who were always ready to assist users in getting out satisfactory mounting schemes.

Vote of Thanks.

Mr. V. C. Faulkner (Branch-President) expressed thanks to the Skefko Ball Bearing Company for the courtesy which they had extended to the London Branch. He would like to tell the Skefko Company that the great difficulty in connection with the application of bearings in foundry work was the fact that there was damp sand present. There had never been a perfect system of conveying sand. In addition to the applications of bearings which Mr. Allen had mentioned, there was the application to the tumbling barrels. There were also the cranes, monorails and the trucks which were seen in some foundries.

Mr. Aires, in a brief response, said that the company were glad to give facilities for such visits, because they were of advantage to both the visitors and the visited, and he supposed it was a question of casting their bread upon the waters. He expressed the hope that the members of the Branch would pay another visit to the works in the future.

The members of the Branch then visited the works of the Davis Gas Stove Company, Limited, where, after an inspection of the foundry and other departments, the Annual General Meeting of the Branch was held.

ANNUAL GENERAL MEETING.

Mr. V. C. Faulkner (the retiring Branch President) was in the chair.

Mr. H. G. Sommerfield (Hon. Secretary), in submitting his report for the session 1924-25, said that the membership, after careful revision, eliminating those who were considerably in arrear with subscriptions, and from whom no response had come after repeated application, showed a decrease on the figures for the preceding session. The Branch, however, suffered nothing by this small decrease, as it was more apparent than real. The membership was more alive and useful to-day than ever, now that it was shorn of those who, for various reasons, had ceased to take any interest in the Institute in general and the London Branch in particular. The membership stood at 154, plus 5 new nominations to come up at the next Council meeting. This compared with the figure given last year of 176, before revision of the Branch register. During the session, 18 new Branch members had been elected by the General Council.

Mr. Sommerfield expressed regret that his long illness last year had prevented him giving the best attention to Branch affairs, but Mr. Faulkner, to whom his best thanks were due, had generously assisted in the preparation of the session's programme of lecturers. The Papers at all meetings had been of a very useful and interesting character.

Diplomas from the General Council had been awarded to Messrs. A. R. Bartlett and J. W. Gardom during the session.

The attendance at all meetings had been very good. In addition to the monthly meetings, the members had rallied in good numbers to visits to Messrs. Morris Motors, Limited, Harland & Wolff, Limited, the South Metropolitan Gas Company, the Skefko Ball Bearing Company, Limited, and the Davis Gas Stove Company, Limited. He regretted to inform the members that during the session he had been notified of the death of two members—Mr. C. A. E. Martin and Mr. R. Rendell.

Mr. Cole Estep, one of the Branch auditors, and a member of the Council, had returned to America early in the session, and was accorded a pleasant farewell dinner by Branch members. Mr. J. W. Gardom had succeeded Mr. Cole Estep on the Council.

The financial position of the Branch was satisfactory, and the Hon. Treasurer had reported a balance in hand of about £50. The Social Fund balance was £2 14s.

At the last Branch Council meeting it had been decided to make the following nomination of officers, for the confirmation or otherwise of the Annual General Meeting.

Branch-President: Mr. Geo. C. Pierce.

Senior Vice-President and Hon. Treasurer: Mr. R. J. Shaw.

Junior Vice-President: Mr. W. B. Lake.

Hon. Secretary: Mr. H. G. Sommerfield.

Councillors: Messrs. Hand, Cleaver and Gibbs had two years to run. Messrs. Shillitoe, Clark and Hall had one year to run.

Messrs. Gardom, Maybrey and Col. Cheesewright retired at that meeting; their offices were consequently vacant, and open for the meeting to fill.

Auditors: Messrs. Bartlett and Maybrey.

These nominations were confirmed by the meeting.

This concluded the business of the Annual General Meeting.

The members were then entertained to tea by the Directors of the Davis Gas Stove Co., Ltd., before returning to London.

MR. FAULKNER proposed a hearty vote of thanks to Mr. Davis, Mr. W. R. Twigg, and the other Directors of the Company, for having afforded facilities for the visit, and for having provided tea. Speaking of the foundry, he said he imagined that it ranked as one of the largest in the south of England. They were all exceptionally indebted to Mr. Twigg and to the guides who had devoted their afternoon to the pleasure of the visitors.

The vote of thanks was accorded with acclamation.

MR. W. R. TWIGG, responding, expressed regret that Mr. Davis was unable to be present. Mr. Davis himself sincerely regretted that he was unable to be present personally and to extend a welcome to the visitors, but he would be very pleased to know that the visit had been interesting. It was a great pleasure to Mr. Davis and his fellow Directors to see foundrymen everywhere and anywhere and at any time. If the visit had afforded the members of the Branch anything in the way of interest, and if they had gained anything by visiting the works, he was sure that Mr. Davis would be pleased. He did not wish the members of the Branch to imagine that these visits could only bestow benefit upon the visitors; he had heard some of the comments of the visitors, perhaps critical, but made with the very best intentions, and he was not at all sure that the Davis Company had not learned more and derived more benefit from the visit than had the visitors themselves. He was sure that it had been as great a pleasure to the gentlemen who had guided the visitors round the works as it had been to himself to do what they could to make the visit pleasant, interesting and instructive, and he hoped they would all meet again in the future in the same pleasant circumstances.

Institute of British Foundrymen.

WALES AND MONMOUTH BRANCH.

At the Swansea Metal Exchange Mr. L. Taverner gave before the Wales and Monmouth Branch of the Institute of British Foundrymen a paper which dealt with the "Application of Metallography to Cast Metals," and said this subject did not appear to have received the due amount of attention from the foundry trades. From an industrial standpoint, metallography is a comparatively new study, and its application has only been introduced on a large scale during the last few years. Perhaps the steel industry has employed this method of investigation more than any other, and here again chiefly on mechanically worked and heat-treated metals rather than for metals in the cast state.

A general description of the plant required for preparing and examining metal specimens was given, and it was shown that recent improvements and advances in these methods had cheapened the necessary plant very considerably and made it possible to prepare specimens in a very short time.

Several instances were quoted where the microscope is now being used as a control method for furnace charges, more especially in the case of high grade non-ferrous alloys.

Special stress was laid on the fact that the identification of many of the defects to be found in metals did not require any advanced theoretical or special knowledge—notably porosity and non-metallic inclusions in their various forms. Cracks and fissures caused or developed by heat treatment and other causes were also discussed, and it was shown that the microscope could be of considerable use in ascertaining whether such defects were present.

A general review was given of the structure of the more common industrial metals and alloys, and how such structures were related to the structures seen on viewing an etched microscopical specimen. Typical structures were chosen in illustration, and it was shown how the alteration of composition changed the microscopical structure, and that this change in structure was accompanied by corresponding changes in the physical properties of the alloys. The advantages to be gained in certain instances by annealing castings in order to bring the material to a state of equilibrium were also considered, and the mode of formation of the typical dendritic structure of the cast alloy was traced from a simple form of equilibrium diagram.

The effect of solidification over a range of temperatures on various impurities was illustrated in the case of several non-ferrous metals, and it was shown that this partial segregation of the impurities frequently gave results which could be usefully employed, particularly in the case of lead-bearing brass for automatic machine work.

The less important groups of alloys having a eutectic structure were shown to possess certain advantages, in special instances, a typical example being the plumbers' solder.

Finally, the speaker gave a short summary showing to what extent metallographic examination could be applied to certain specified alloys, and concluded by showing a few lantern slides in illustration of the paper.

In the course of the discussion, MR. TAVERNER stated that there was trouble in polishing cast iron through the graphite being dragged out, and suggested that in the case of cast iron 500 magnifications and for non-ferrous metals 100 magnifications should be used.

The meeting was a small one, and took the form of a "round table chat," and concluded with a vote of thanks to the lecturer, proposed by Mr. McClelland, seconded by Mr. Galletly and supported by Mr. Taylor.

THE AMOUNT necessary to meet the half-year's interest on the eight per cent. first mortgage sterling debentures of the Skoda Works, due July 1, 1925, has been deposited with the National Provincial Bank.

THE SHAREHOLDERS of the Coltness Iron Company, Limited, have confirmed the special resolution increasing the capital to £1,287,500. The allotment of the new ordinary shares at par will be made to the ordinary shareholders in the proportion of one new share for every two held.

Trade Talk.

FERRANTI, LIMITED, have removed from 180, Fleet Street, E.C.4, to Bush House, Aldwych, W.C.2.

Two of the steel furnaces at the Consett Iron Company's works will be put into operation in the course of a month.

KASENIT, LIMITED, have removed into larger and more commodious premises at Henry Street, Bermondsey Street, S.E.1.

VICKERS, LIMITED, have secured an order for 100 of their single-battery electrically-regulated train lighting equipments for the new passenger carriages building for the London, Midland and Scottish Railway.

H. CLARKE & COMPANY (MANCHESTER), LIMITED, Cooke's Explosives, Limited, McKechnie Bros., Limited, Ernest Turner & Company, Arthur Vigor, Limited, and Wadsworth & Company, Limited, have joined the Federation of British Industries.

THE NEW LONDON LEAD COMPANY, LIMITED, have been formed for the purpose of working the lead mines of Upper Teesdale, which the old London Lead Company relinquished in 1902, after having worked them since the formation of the company in 1688.

HOWDEN-LJUNGSTROM PREHEATERS (IAND), LIMITED, 133, Helen Street, Govan, Glasgow, have received an order to supply one preheater to the Cauldon Potteries, Limited. The total heating surface is to be 6,220 sq. ft., air being supplied at about 580 deg. Fah.

IN CONNECTION with their renewals scheme, the London, Midland and Scottish Railway have placed an order with the Midland Railway Carriage and Wagon Company, Limited, Birmingham, for a number of 40-ton well trollies. These trollies have a well of 25 ft., and are for the conveyance of very heavy traffic.

PNEULEC MACHINE COMPANY, LIMITED, Mafeking Road, Smethwick, near Birmingham, have appointed Mr. W. Waby, of 11, Northwood Street, Stapleford, Nottingham, as their agent in the counties of Nottingham, Lincoln, and Leicester, and also Derbyshire, excluding the towns of Staveley, Chesterfield, Bolsover, Whittington and Dronfield.

A LARGE STATOR, weighing 48 tons, designed for a new 20,000 kw. generator, has been successfully conveyed to Bradford power station by the London, Midland and Scottish Railway. This is the biggest feat yet accomplished by the staff of the Valley Road Goods Station. The stator made the journey from Newcastle in a 12-wheeled truck weighing 38 tons, 67 feet in length. The process of dismounting and conveying to the power station was an exacting undertaking, a special rubber-tyred traction engine being pressed into service for the haulage.

IT IS ANNOUNCED that the firm of Alfred Hickman, Limited, of the Springvale Steelworks, Bilston, are going into voluntary liquidation, but it is merely a matter of internal policy on the part of Stewarts & Lloyds, Limited, of Glasgow, who have for some time past held the whole of the shares. The works, where about 2,000 hands are normally employed, will go on as before, and it is understood they will continue to trade under the name of Alfred Hickman, as a branch of Stewarts & Lloyds, Limited. The change merely provides that the Bilston works will become a closer integral part of Stewarts & Lloyds, Limited, and that administrative economies will thus be effected.

THE PARTINGTON STEEL & IRON COMPANY, LIMITED, last week made an issue of £300,000 in seven-and-a-half per cent. five-year notes at 98 per cent. The notes, which will replace the similar amount of six-and-a-half per cent. five-year notes repayable on June 30 next, are redeemable at 102 per cent. on June 30, 1930, and are guaranteed unconditionally as to principal and interest by the Pearson and Knowles Coal and Iron Company, Limited. Formed in 1910, the company owns about 192 acres of land on the Manchester Ship Canal between Liverpool and Manchester. Their works have a capacity for the production of 7,000 to 8,000 tons per week of steel ingots and castings. The company owns the lease of ironstone mines at Wakerley, Northants, half the shares and debentures of the company working the Wolstanton Mines, near Stoke, and has also acquired a lease for 50 years from 1920 of limestone quarries turning out 2,000 tons per week in North Wales. Tar macadam and other materials are made from the blast-furnace slag, and the company undertakes road making. The balance-sheet at June 30 last showed an excess of assets over liabilities of £2,222,954.

U.S. Open-Hearth Committee.—For the purpose of an exchange of ideas as to operating open-hearth furnaces and standardisation of furnaces, practice and materials, an open-hearth committee of the independent steel companies has been formed in America as a result of a conference held at Pittsburgh at the middle of April.

Obituary.

MR. F. HERBERT, J.P., of Stocksbridge, has died at the age of 65. For 16 years he was manager of the Birtley Iron Works, County Durham, and he held a similar position at the works of Messrs. Jordan, of Newport, Mon.

MR. J. SAMPSON, who died last week, was a director of the Coventry Ordnance Works, Limited, the English Electric Company, Limited, Harland & Wolff, Limited, John Brown & Company, Limited, the Projectile & Engineering Company, Limited, and Thos. Firth & Sons, Limited. Before the English Electric Company was formed Mr. Sampson was for many years on the board of Dick Kerr & Company, and his influence on the development of these and of the other great concerns with which he was associated was as profound as it was unostentatious.

MR. A. E. WELLS, of Southlands, Moorgate, Rotherham, who died last week, was a prominent commercial authority and a well-known steel manufacturer in the Rotherham and Sheffield district. He was in his 68th year. Mr. Wells was managing director of Edgar Allen & Company, Limited, Imperial Steel Works, Tinsley. He was a son of the late Mr. George Wells, of J. & G. Wells, Limited, colliery owners, and was born at Eckington, Derbyshire. Educated at the Academy, Bradford, he commenced his connection with the steel industry in 1874, and in 1890 Mr. Wells joined Mr. William Edgar Allen in business operations at Tinsley. In public affairs he did not come into prominence, but as a member of the Rotherham and District Chamber of Commerce he ultimately became president.

Contracts Open.

Warrington, May 23.—3,000 yards of 3-in. cast-iron pipes, for the Water Committee. Mr. J. Gray, water engineer, Municipal Office, Warrington.

Melbourne, June 10.—Tyres, for the Victorian Railways: Contract No. 38276, 2,042 steel tyres. The Department of Overseas Trade (Room 50).

Chichester, May 30.—Five miles of 12-in. diameter cast-iron water mains and special pipes, for the Town Council. The City Engineer, Mr. F. J. Lobley. (Fee, £3 3s., returnable).

Johannesburg, May 30.—Axles, for the Municipal Council of Johannesburg; 50 4½-in. tramcar axles (Contract No. 452) Department of Overseas Trade. (Ref. No. A.X. 1984.)

Plymouth, May 18-June 5.—Supply and erection of 1,500-kw. converter, for the Corporation. Mr. E. G. Okell, borough electrical engineer, Electricity Works, Prince Rock, Plymouth.

Melbourne, June 3.—Rails, for the Victorian Railways: Contract No. 37764, 4,682 tons 60-lb. rails and 320 tons of fishplates. The Department of Overseas Trade (Room 50). (Ref. No. A. 1990.)

Wellington, N.Z., August 10.—Electric capstans, etc., for the Napier Harbour Board: two electric capstans, 12 fairleads, and one portable crane, either hand or electric. The Department of Overseas Trade.

Darlington, May 29.—Supplying and erecting six electrically-driven centrifugal or turbine pumps, of capacities 4,000 (No. 3) 2,000 and (No. 2) 1,000 gallons per minute, respectively, for the Corporation. Mr. E. Minors, waterworks engineer, Town Hall, Darlington.

Company News.

Arrol-Johnston, Limited.—Profit, £9,547; brought forward, £11,038.

J. I. Thornycroft & Company, Limited.—Interim dividend, 5 per cent. on preference shares, less tax.

Robert Fife, Limited, 19, Buckingham Street, Strand, London, W.C.2.—Capital £500 in £1 shares. Brass-founders.

Manganese Bronze and Brass Company, Limited.—Net profit, including £3,982 brought in, £10,485; carried forward, £10,485.

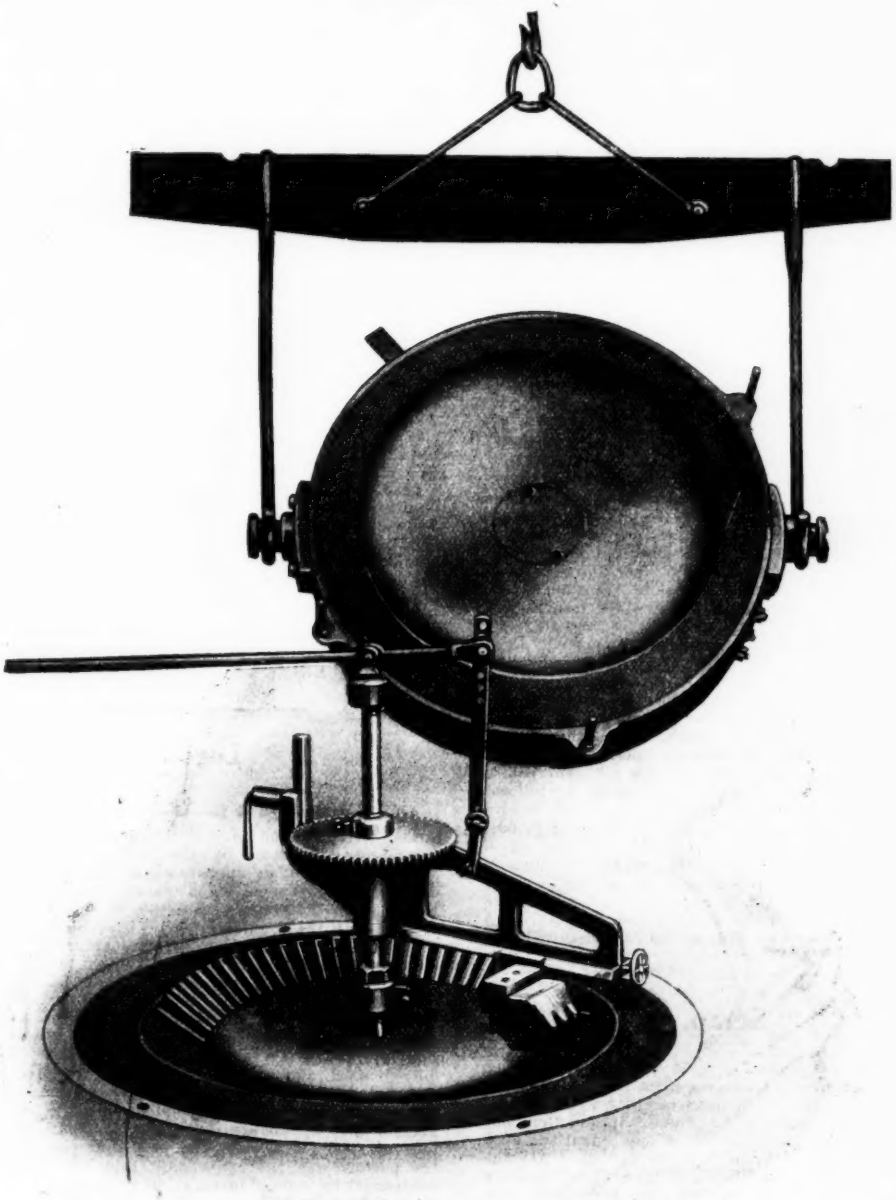
Dorman, Long & Company, Limited.—Half-yearly dividend on cumulative preference shares, 6 per cent. per annum, less tax; no interim dividend on eight per cent. preferred ordinary or ordinary shares.

Sir W. G. Armstrong Whitworth & Company, Limited.—Balance profit and loss account, £505,250; brought forward, £679,768; interim dividends, £264,062; further dividends, £264,062; carried forward, £656,893.

William Baird & Son, Limited, Temple Iron Works, Anniesland, Glasgow.—Capital £40,000 in £1 shares (15,000 6 per cent. cumulative preference and 25,000 ordinary). Engineers. Directors: W. M. Baird and W. C. Warrand-Connal.

The "VULCANIA" PATENT WHEEL MOULDING MACHINE.

Patent No. 5049.



THE "VULCANIA" PATENT WHEEL MOULDING MACHINE is for moulding spur wheels with straight, sloping or Vee-shaped teeth, also bevel wheels, skew gear wheels, worm wheels and internal wheels. The machine head is carried on a pillar which is held in a base-plate bedded in the floor sand, and is made to slide on the pillar by means of a lever and link carried on a joint bearing, or by rack and pinion, or screw if thought advisable for the particular work it is being used for.

An adjustable stop collar is provided for accurately deciding the depth of mould. On the removable head a slide is carried for supporting the patterns of the teeth to be moulded. This slide is made adjustable by screw or pinion gearing to the diameter required. The number of teeth to be moulded is decided by a special dividing plate into which a steel wedge or finger engages. The special dividing plate has milled vees, at the angle of 60° inclusive, around its circumference, to receive the steel wedge, which is adjusted by a screw having an internal spring to keep it in tension and to lock the head when ramming operations are being carried out.

JAMES EVANS & CO., BRITANNIA WORKS,
(MANCHESTER), LIMITED,
BLACKFRIARS, MANCHESTER.

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—The position in the Cleveland iron market foreshadows little general improvement in the near future, and may, perhaps, best be described as only quietly steady, with forward business confined within very moderate limits. On Tees-side there is very little foundry iron in stock, and a real shortage of this material for the open market is thought to be by no means improbable if there should be any further curtailment of output. Values meanwhile reflect a weaker tendency, No. 3 G.M.B. having been done for export at 76s. per ton, while 75s. 6d. would be freely accepted for truck iron. No. 1 was steady at 81s., and No. 4 foundry and No. 4 forge were offered at about 75s. and 74s. per ton respectively.

No change can be noted in the market for hematite, but, if anything, there is a slight improvement in turnover. East Coast mixed numbers are quoted 80s. 6d. per ton, with 6s. extra for No. 1 quality. On the North-West Coast markets are quiet, with Bessemer mixed numbers quoted at 87s. 6d. per ton c.i.f. Welsh ports, 91s. 6d. per ton delivered at Glasgow, 97s. 6d. per ton delivered at Sheffield, and 100s. per ton delivered at Birmingham.

LANCASHIRE.—Business in the leading local markets for foundry iron continues on an attenuated scale, consumers remaining under the impression that prices will be shortly more favourable from the buyers' point of view. Northamptonshire foundry iron remains at 70s. per ton on trucks, equal to 82s. 8d. per ton, delivered in Manchester. Sellers of Derbyshire foundry iron usually quote 84s. per ton, delivered locally, but as this means a furnace price of 6s. per ton more than that current in Northamptonshire, consumers are strongly of opinion that the Derbyshire iron is put too high.

THE MIDLANDS.—As previously reported, local demand for foundry iron does not give any indication of a better state of affairs. The ironfounders are finding business extremely difficult to get, and the prices being obtained are cut to the finest limits. With the bottom not yet touched, consumers' attitude in keeping their purchases to small quantities to keep them going from time to time may be readily understood. Ruling prices for pig-iron are as follow: Derbyshire No. 3 foundry, 75s. to 76s.; Staffordshire No. 3 foundry, 75s.; Northants No. 3 foundry, 69s. to 70s.

SCOTLAND.—The outlook in the Scotch pig-iron industry continues depressed, and any orders in circulation are only for trifling quantities. Under these conditions prices continue to fall, and Scotch No. 3 foundry now is not over 86s. at the furnaces.

Scrap.

The present stagnation in most consuming industries continues to exercise an adverse effect upon the demand for cast-iron scrap, which until recently was regarded as a staple raw material for foundry production, but is now difficult to dispose of in any quantity, even at the low scale of prices now prevailing. At the moment, Lancashire dealers are fairly firm, because the supply of good cast scrap is not very large, but the extreme weakness of the pig-iron market seems to be undermining confidence. Special prices up to 85s. are still asked for lots of textile scrap, but these do not occur very frequently now, as in the present condition of the cotton trade there is not much breaking-up of textile material. In Scotland, machinery and cast-iron scrap still remain quiet. Some small tonnage changed hands last week at 85s. to 86s. 3d. per ton, that is for pieces not exceeding 1 cwt., and for ordinary cast-iron scrap to the same specification 5s. per ton less. Light cast-iron scrap and firebars still remain quiet, and many parcels are being offered at as low as 65s. per ton, but with few buyers. The above prices are all per ton, delivered f.o.b. consumers' works.

Metals.

Copper.—Movements in the market for standard metal of late have been chiefly confined within very narrow limits, political uncertainty at home and abroad, over-production and speculative selling pressure combining as adverse factors in restraint of business expansion. Stocks have also increased several hundred tons, and generally speaking it may be taken that unsettled markets will be the order of the day until the political atmosphere both in Great Britain and on the Continent clears a little. Current quotations :—*Cash* : Thursday, £60 5s. : Friday, £60 7s. 6d. ; Monday, £60 7s. 6d. ; Tuesday, £60 5s. ; Wednesday, £60 2s. 6d.

Three Months : Thursday, £61 2s. 6d. ; Friday, £61 7s. 6d. ; Monday, £61 7s. 6d. ; Tuesday, £61 2s. 6d. ; Wednesday, £61.

Tin.—The tin position continues variable, with values inclined to a stronger tendency, taking recently a sharp upward curve. In the East, business has been done at £246, and at the moment there are buyers over, with but a few sellers. This is a point which must appeal with special significance to American dealers. The United Kingdom stocks are again reduced, now standing at about 3,850 tons. Fears are expressed that further buying for foreign account will deplete them still more. Current quotations :—*Cash* : Thursday, £244 5s. ; Friday, £243 12s. 6d. ; Monday, £244 7s. 6d. ; Tuesday, £245 ; Wednesday, £246 10s.

Three Months : Thursday, £246 5s. ; Friday, £246 ; Monday, £246 15s. ; Tuesday, £247 ; Wednesday, £248 10s.

Spelter.—Conditions in this section of metals have varied to small extent of late, but sellers are more reserved, and offers from the Continent are more numerous. As consumption in Germany has been less active, that country is able now to supply her own requirements. For this reason greater quantities of Belgian spelter should be available for the British market. Current quotations :—*Ordinary* : Thursday, £34 ; Friday, £33 18s. 9d. ; Monday, £34 ; Tuesday, £33 17s. 6d. ; Wednesday, £33 17s. 6d.

Lead.—Consumptive demand for soft foreign pig has slightly improved, with somewhat less selling pressure in evidence. A few months back the price rose to well over £40 per ton, and in some directions a famine was freely predicted. This was rather unfortunate, as such talk simply puts buyers off the metal, and during the last month or two there has been a very severe relapse. Current quotations :—*Soft foreign (prompt)* : Thursday, £31 15s. ; Friday, £32 2s. 6d. ; Monday, £32 10s. ; Tuesday, £32 2s. 6d. ; Wednesday, £32 6s. 3d.

Legal.

Edgar Allen & Co. v. Victor Stobie.

The interpretation of a contract for the supply of two electric furnaces by the Stobie Steel Company was the issue in an appeal which was concluded in the Court of Appeal on Tuesday. Appellants were Edgar Allen & Company, Limited, Sheffield, who contracted with the defendant, Mr. Victor Stobie, trading as the Stobie Steel Company, at Dunston, for the two electric furnaces.

Mr. Lowenthal, in support of the appeal, said the furnaces cost £14,000, or, with the cost of installing them, about £20,000. In 1918 appellants proposed to fit out new steelworks, and heard that respondent had invented a new electrical duplex furnace for producing steel and which, he claimed, resulted in a material economy in electrical power. Appellants accordingly approached respondent. It was common ground that appellants required a production of 200 tons of steel per week. The only difference between the parties was that appellants said the respondent contracted to supply furnaces to produce 200 tons of steel a week on a consumption of 700 units per ton, whereas respondent said the furnaces were merely to produce the quantity named at a commercially economical cost. When the furnaces were delivered they failed to do what was required, and therefore tests were made. Though at the fourth test an output of 200 tons was managed, it was (appellants said) at a very much greater output of energy than that contracted for. The appellants brought the action for a declaration that they were entitled to reject the furnaces and to the return of the money they had paid for them, and also for damages for breach of contract.

Mr. Justice Greer found that defendant had agreed that it was an implied term of the contract that the furnaces should produce 200 tons of molten steel per week at a commercially economic cost; but he found against the appellants (plaintiffs) upon their claim that there was a guarantee that the furnaces would work at not more than 700 units, and that the rest of the case fell to be decided upon those lines. From this result Edgar Allen & Company, Limited, appealed.

On Tuesday the appeal was dismissed. The judgment was that in a contract for a Stobie duplexing steel-melting plant no guarantee had been given for a specific current consumption, but only for an output of 200 tons of steel weekly to be produced at a commercially economical cost.